# Journal

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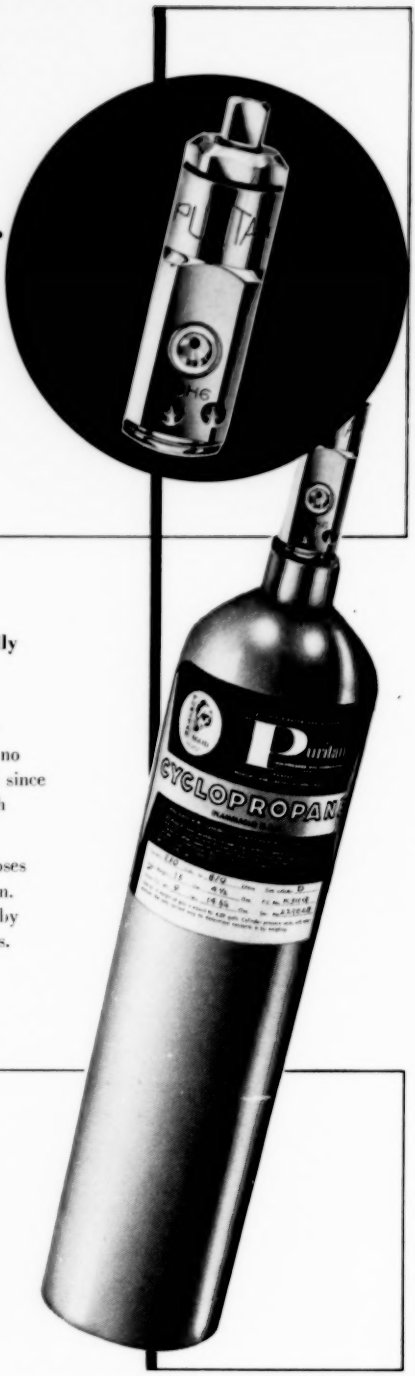


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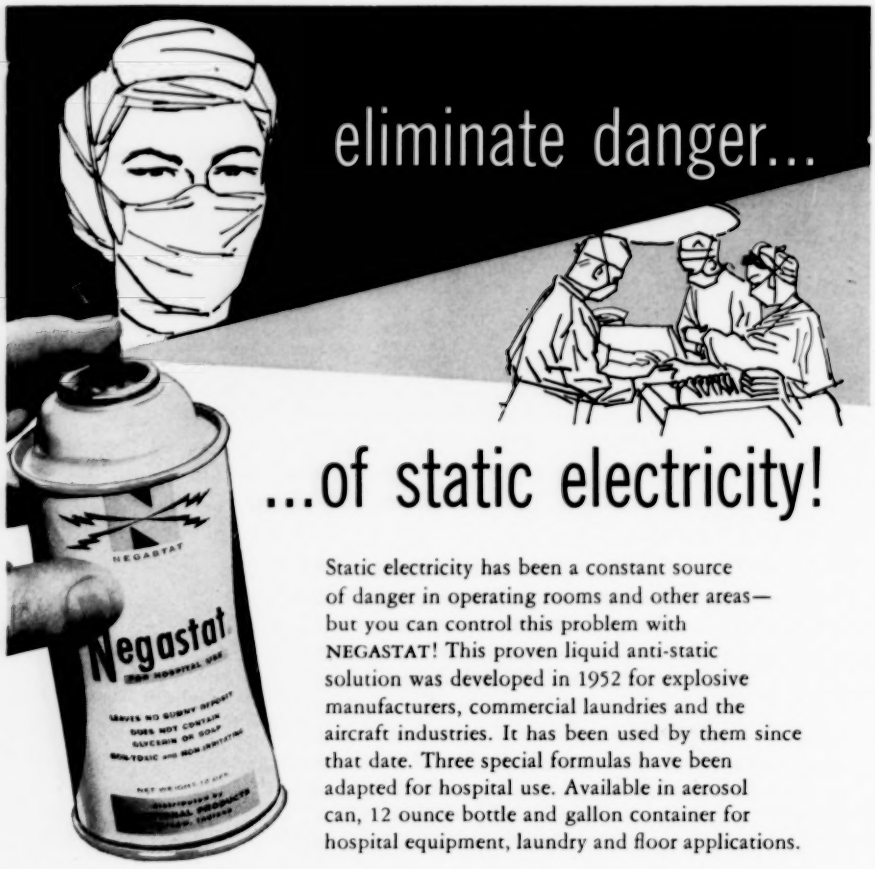


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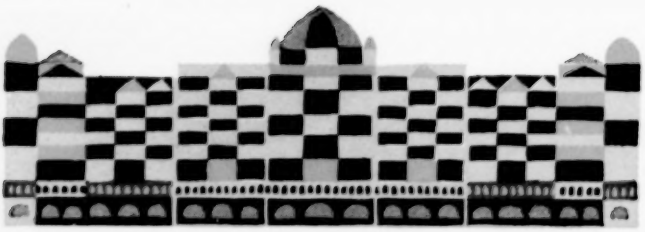

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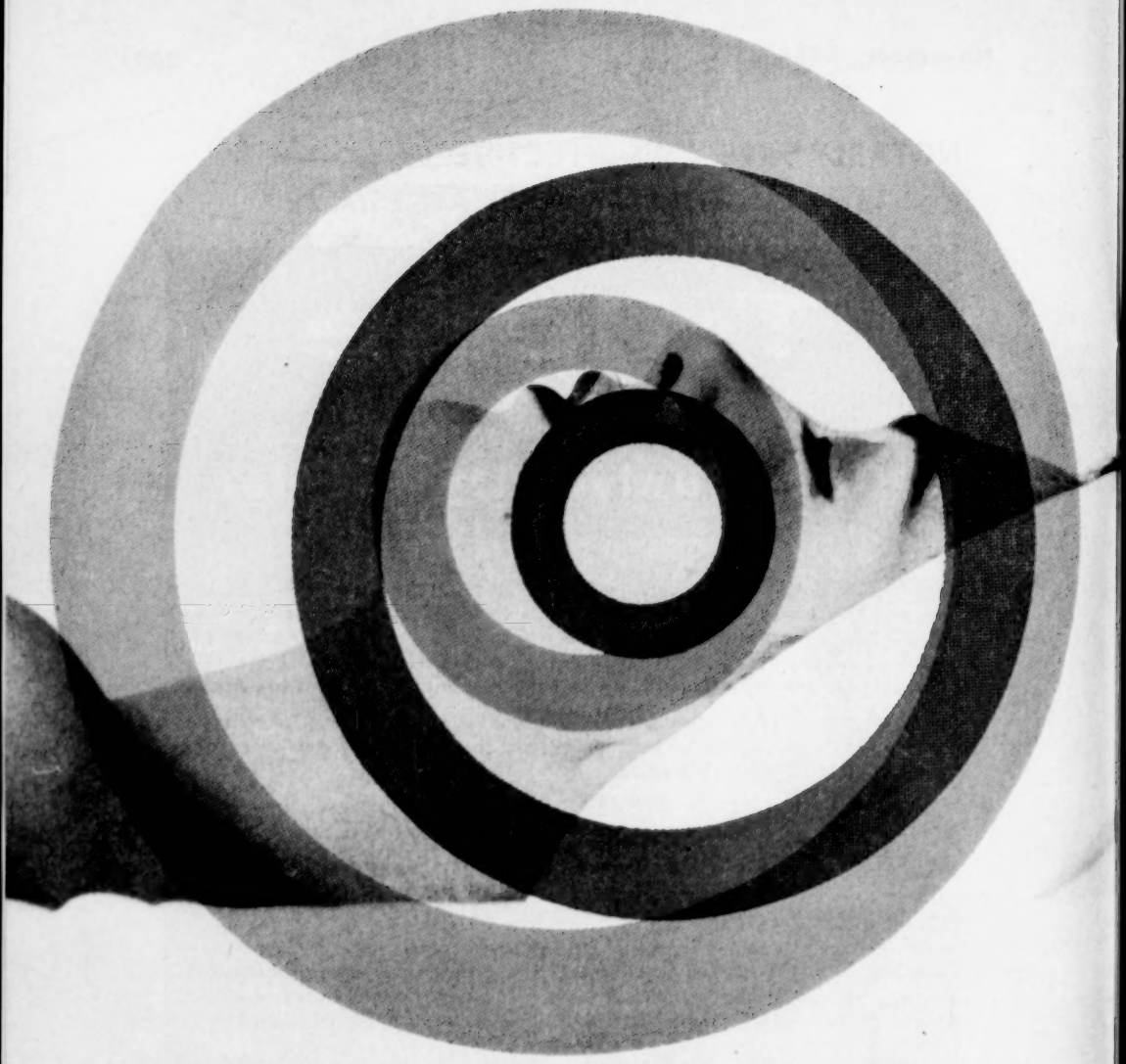

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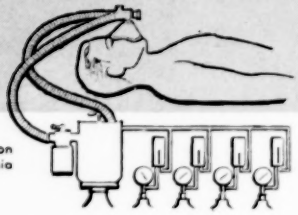

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# VAPORIZATION

EDITOR'S NOTE: *The following is an abstract of an article by Wayne Hay, Ohio Chemical Product Engineer, which is currently appearing in the November issue of "Anesthesia Items," published by Ohio Chemical & Surgical Equipment Co.*

In this article on vaporization, the author discusses the advantages and disadvantages of three basic types of vaporizers and describes the mechanics of vaporization. His description begins with an explanation of the physical factors involved in converting a substance from a liquid to a gas. An understanding of the physical phenomena of vaporization is primary to understanding the various methods by which a liquid is vaporized.

## HEAT

Heat plays a part in vaporization in two different ways — specific heat and latent heat. The specific heat of a material is defined as the number of calories (a unit of heat) required to raise one gram of any substance one degree centigrade. Latent heat is the number of calories required to change a gram of liquid to a gas without affecting the temperature.

## PRESSURE

Pressure is the second basic factor in vaporization and is defined as a force exerted over an area. Partial pressure is that pressure exerted by one gas or vapor in a mixture of gases. In a 10% mixture of ether and oxygen, ether exerts 10% of the total absolute pressure and oxygen 90 percent. Vapor pressure is the absolute pressure at which a vapor would be at equilibrium with its liquid at a given temperature. Vapor pressure of a liquid increases as the temperature increases. Ethyl chloride, for example, has a vapor pressure higher than atmospheric at room temperature. This is why ethyl chloride immediately evaporates on exposure to the atmosphere.

## MECHANICS OF VAPORIZATION

The author uses ether as an example in his explanation of the mechanics of vaporization to illustrate the meaning of heat, both latent and specific, and pressure, both partial and vapor. When ether is first introduced from an in-circuit type vaporizer, the flow of gas through the vaporizer will displace some ether vapor, reducing its partial pressure in the jar below the vapor pressure of the liquid ether. The liquid will then begin to evaporate to restore the equilibrium of the ether vapor pressure. The latent heat required for vaporization will be extracted from the unevaporated liquid and from the jar itself, lowering their temperatures and consequently the vapor pressure of the remaining liquid.

As the vapor pressure of the liquid falls, the rate of evaporation falls. The difference in temperature between the liquid ether and the vaporizer environment causes heat to flow into the vaporizer. If the ideal situation existed where no ether vapor was lost from the circuit, the in-flow of heat would decrease gradually until the liquid ether had regained room temperature. However, it is an unobtainable condition and therefore some means must be provided to supply heat to the vaporizer.

## VAPORIZERS

In the discussion of vaporizers three distinct types are described. The first type utilizes a wick which in effect extends the area of vaporization. The chief disadvantage is that the cotton wick has a greater affinity for water than for ether, and condensate from exhaled water vapor tends to take possession of the wick so the rate of evaporization decreases. This offers some degree of automatic protection against overdosage.

The second type involves a vaporizer through which a gas mixture is bubbled to entrain ether vapor. This gas is essentially dry so no decline due to moisture condensation occurs. However, the glass jar which is common to both the first and second types has a poor thermal conductivity, causing a falling output in each which differs only in degree.

The third type of vaporizer owes its popularity to the fact that with it ether vapor can be metered as if it were a permanent gas. This type of vaporizer is usually a metal vessel of sufficient size to provide adequate thermal conductivity to maintain the temperature of the liquid ether substantially higher than the first two types. Oxygen is usually the gas bubbled through the vaporizer. Equal volumes of oxygen and ether vapor are assumed to issue from the vaporizer, which for most practical purposes is true. The chief disadvantage of this technique is that no automatic protection is inherent and the need for continued vigilance is mandatory to prevent an overdose of ether.

*The complete article is available upon request. Please write Ohio Chemical & Surgical Equipment Co., 1400 East Washington Avenue, Madison 10, Wisconsin—Dept. ANA-12.*

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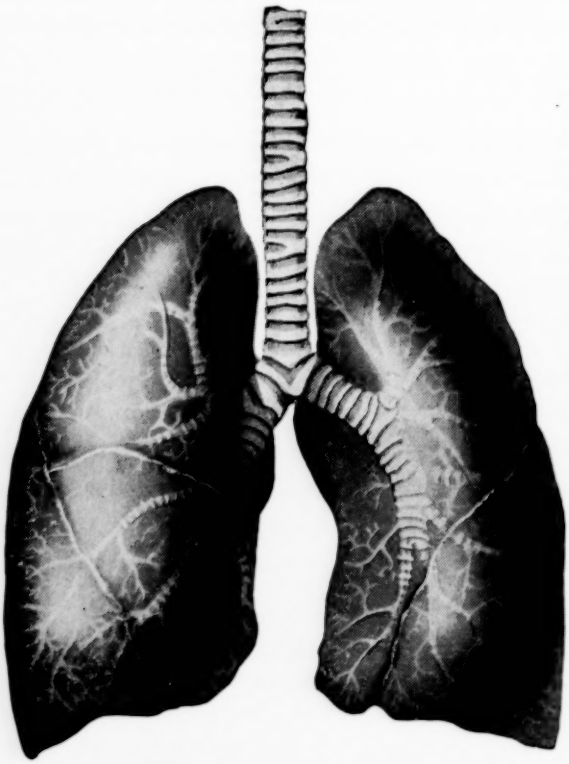

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# Role of the Nurse Anesthetist in the Treatment of Burns

Gloria A. Blado, C.R.N.A.*
Chicago, Illinois

The role of the nurse anesthetist in the treatment of the burned patient can be of great importance. Those of us who work in Cook County Hospital, Chicago, have many occasions for practicing the principles of good care for these patients. During the past 5 years 4,270 burned patients have been treated at Cook County Hospital. In 1957 alone there were 306 adults, of whom 29 died as a result of their burns, and 342 children, of whom only 3 died as a result of their burns.

The regime of treatment of the burned patient which is consistently carried out by the Doctors and Nurses of the Cook County Hospital is as follows:

Upon admittance to the hospital the patient is immediately evaluated for shock, the extensiveness of the burned area, and then treated accordingly. If necessary, emergency treatment for shock is instituted at once. The care of the burned area should be restricted to covering with sterile sheets, until such time as the patient's condition will permit adequate cleansing and care.

## Early Treatment for Shock

A needle or polyethylene tube is inserted into the vein and a blood sample is withdrawn for chemical analysis and typing. Preferably normal saline is started, followed by dextrose 5% in water, whole blood or plasma if blood is not available at the time. A severe burn requires more oxygen carriers, as the red cells have been severely damaged and the use of whole blood will help to rectify this condition.

Any patient with burns involving more than the normally exposed surfaces of the body, such as the hands, feet, and face, is considered a candidate for burn shock. Burn shock is a constant danger for the first 72 hours.

The percentages of burns are roughly estimated by the "Rule of 9" which is as follows:

| | |
|---|---|
| Upper extremities each | 9% |
| Lower extremities each | 18% |
| Head and neck | 9% |
| Anterior trunk | 18% |
| Posterior trunk | 18% |
| All irregular areas such as the palm | 1% |

*Chief Nurse Anesthetist, Cook County Hospital, Chicago, Illinois.

Presented at the Annual Meeting, American Association of Nurse Anesthetists, Chicago, August 21, 1958.

### Calculation of Blood and Fluid Intake

The patient's weight is expressed in Kilograms which is 2.2 lb. of body weight. Estimate 1cc. fluid per Kilogram for each 1% of surface burned. For example, a patient weighing 75 Kilograms with a 30% burn would require the following: 75 (kg.) x 30 (% burn) x 1cc. equals 2500cc. of blood or plasma, plus an equal amount of electrolyte solution, plus 2000cc. of water for normal fluid loss. This is known as Evans Formula for blood and fluid loss. Fluid and electrolyte therapy is most important in the early management of the burn patient. There is a decrease in circulating plasma, water, and electrolytes. Proteins leave the vessels and pass into the interstitial space around the burned areas and large amounts of sodium enter the edema fluid around the burn. Colloid requirements in early treatment may be met with whole blood, plus plasma, or plasma expander. This treatment is of the greatest importance to the patient. Whole blood does not elevate the already high hematocrit and if given in large amounts early for shock, it is believed to minimize or at least favorably affect the secondary anemia which so often occurs in the burned patient.

The urine output is a most valuable guide to the adequacy of fluid intake. In an average size adult the urinary output should be from 25 to 50cc. per hour during the period of burn shock. In children the output is proportionate to their age group.

A Foley catheter is introduced into the urethra and the first urine sample is withdrawn for examination. Thereafter the urine is measured each hour.

In the absence of vomiting, the normal intake of water may be given orally instead of intravenously. After the first 24 hours the amount of blood and plasma requirements are usually less, approximately one-half of the amount given the first day. At the end of the second day, the patient usually reaches a stable state and oral feeding and intake is sufficient.

### Dressing the Burned Area

The patient should be placed in a warm room protected from drafts. Ordinarily no anesthesia is required or used for the initial preparation of the burned surfaces because: (1) There is danger of precipitating or aggravating burn shock; (2) The patient frequently has a full stomach; (3) The possibility of burn of the respiratory tract. Frequently restlessness is interpreted as a symptom of pain when it is indicative of shock.

### Sedation — Not Anesthesia

If sedation is thought to be necessary to alleviate pain, morphine may be given in small doses, intravenously. Subcutaneous or intramuscular administration is ineffective in the presence of shock because of the slow peripheral absorption. The subsequent danger of morphine poisoning which may occur when peripheral circulation improves, is another reason for avoiding repeated subcutaneous injections of this drug. Small doses of barbiturates given rectally, or intravenously, are helpful in calming the restless, hysterical patient. Rectal injections are particularly beneficial in quieting children.

### Cleansing of the Wound

Under strict asepsis, the surgeon and his assistants gently cleanse the

burned areas with bland soap and sterile warm water. Following the cleansing, the area is rinsed with warm sterile water or saline, then patted dry with sterile towels. The surgeon and his assistants should then change gloves and gowns, and with forceps and scissors proceed to remove loose tags of tissue and blisters. Other than this, no devitalized tissue is disturbed during the initial phase of treatment.

After cleansing, a fine mesh gauze that does not adhere, and is translucent, slightly impregnated with petrolatum is laid directly over the burned surface. It is then covered with massive, springy, dry, fluffed gauze. This in turn is covered with large burn packs, held in place by woven elastic bandages, applied evenly to avoid constriction. It is extremely important to splint all extremities in the functional position. During this procedure it is sometimes helpful, especially with a patient in impending shock, to administer oxygen. Due to the diminished blood volume and red cell content of the blood, the patient may suffer from hypoxia. During this cleansing and dressing of the burn, the surgeon attempts to estimate the depth and extent of the burn surface for use as a rough guide to fluid therapy.

Following the initial care, the patient is moved to his bed with intravenous fluids having been started previously, and if necessary a Foley catheter is placed in the bladder.

### Burns of the Respiratory Tract

Patients who have been subjected to flames or hot smoke, may suffer from a burn of the respiratory tract. We cannot overemphasize the importance of the necessity of observation for indications of respiratory obstruction. These obstructions may be caused by edema of the larynx, glottis and trachea. Frequent aspiration of secretions from the trachea is often necessary to alleviate obstruction. On occasion, tracheotomy has been performed as a lifesaving measure. Anesthesia should be avoided at this time except for the administration of oxygen to help prevent hypoxia caused by the obstruction.

### Tetanus and Antibiotics

At the time of the initial care of the patient, antitoxin is administered if there has been great destruction of the skin. Patients with extensive burns should also receive antibiotics. Generous doses of Penicillin should be given daily and until the temperature remains normal for several days.

### Dietary and Fluid Intake Following Initial Shock

The patient is permitted to eat at once, or as soon as he will tolerate food. Fluids are also given orally if tolerated. If the patient has a persistent emesis, the electrolytes must be replaced intravenously. A real protein loss has occurred and continues to occur until the burn is healed. After 48 hours, the fluids are to be administered only in quantities sufficient to take care of the physiologic needs of the patient. Transfusions of blood should be given every second or third day for several weeks in an attempt to minimize anemia and also to combat protein deficiency.

A diet rich in proteins and high in calories with large amounts of multiple Vitamins, especially Vitamin C, is essential for the nutritional losses

which exist so long as the burn remains unhealed.

Nasal tube feeding may sometimes become necessary in patients with poor appetite or for supplementary feedings.

### Evaluation of Burn Area

The initial dressings are not disturbed for 5 to 8 days over areas where a full thickness loss of skin is anticipated. Partial thickness burns may be left for 10 days and often heal in 14-18 days without surgical procedure. Full thickness loss of skin usually requires surgical excision. The surface excised is covered immediately with compression dressings omitting the petrolatum gauze. Skin grafting is not done at this time. The excised surface is moist and bleeding and grafts are likely to pull away. The added bleeding, which occurs with excising of a graft, may be adding to the shock which may be present due to the debriding of the burned tissue.

### Surgical Debridement

The patient's first visit to surgery is for the debridement of slough tissue. This being a very painful procedure, the patient must be anesthetized. Surgical excision of the burned area of the face and neck is rarely done, because the excellent blood supply quickly separates the slough, making excision seldom necessary. However, the burned areas are not confined to this part of the body in cases of extensive, s e v e r e burns. When the head, face, and throat are involved, compression dressings on these areas cause complications in the administering of anesthesia.

The amount of debridement that can be done depends largely upon the patient's condition, the amount of blood loss, and the rapidity of the excision of the slough areas. We have had patients with extensive 50-60% burns that have come to surgery several times before the slough areas were completely debrided. The generous use of blood to help combat shock at this time is very important.

The application of the dressings and compression bandages must not be constricting to the respiratory functions. This is most important and it is the Anesthetist's duty to make sure that the patient has a good respiratory exchange and patent airway before leaving surgery.

### Anesthesia for the Burn Patient

The placing of anesthesia mask on the patient with burns of the face and throat is sometimes difficult, because of the compression dressings. The patient's head is in an inflexible position and may cause obstruction of the respiration. Edema of the glottis and larynx may also be present adding to this complication. Endotracheal anesthesia in these types of cases is definitely indicated. Topical anesthesia for intubation or when possible, trans-tracheal block should be used. When trouble is not anticipated, the usual method of anesthesia and intubation is followed.

Children with extensive burns in this area present us with our most difficult problems. It is imperative that they have an unobstructed airway at all times. Intubation of these children can be very difficult and on occasion, as in the adult patient, emergency tracheotomy must be performed. Fortunately, at Cook County Hospital, we rarely have had to resort to this procedure.

All precautions against obstruction or embarrassment of respiration must be taken with patients placed in the prone position for surgical procedures. Again, for this type of procedure, I suggest endotracheal anesthesia.

The types and methods of anesthesia are varied. Intravenous fluids and available blood is imperative before the administration of the anesthetic. Hemoglobin levels, adequate for the usual general anesthetic, may be totally insufficient for the burned patient.

Intravenous anesthesia, by the drip or syringe method combined with nitrous oxide and oxygen, or cyclopropane are our usual choice to be used in adults and large children. In the lower aged group, trichlorethylene, or vinethene induction followed by ether with a high flow of oxygen is preferred.

The depth of anesthesia need not be below the second plane. The choice of agent used, should be one you are most skilled in administering with the highest oxygen concentration, and the least toxic to the patient.

### Use of the Blood Pressure Cuff

Placing of the blood pressure cuff is sometimes impossible, as the area to which a cuff is usually applied is eliminated because of compression dressings over the burned surface. Even palpating a pulse at the temple or wrist is denied because of the burn or dressing, and must be felt where it is accessible. The rate and quality of the pulse is very important in determining the condition of the patient, especially children. A pulse rate over 160 in children is very serious and most surgeons will discontinue the debridement, or grafting until the patient's condition has improved.

### Changes of Position of the Patient

The positioning of the patient during anesthesia must be done with great care, as you no doubt are familiar with the shocking effects of position changes in the anesthetized patient. This is particularly true at the termination of surgery. After the insult of blood loss and surgery, no shock can be more difficult to combat.

## Skin Grafting

When the condition of the patient permits, and the burned areas are ready for grafting, the patient returns to the operating room for autogenous grafting. Skin graftings may be done 2 to 3 days after debridement. The surface at this time is not granulated and takes grafts well. Extensive burns may require more than one skin grafting because of insufficient donor sites. The same site may be used again in three weeks, providing the layer of skin removed at first grafting is not too thick.

On frequent occasions, it may require 5 to 10 visits to surgery depending on the areas to be covered, and the condition of the patient during the procedure. Once the grafts are taken, and there are signs of shock, the anesthesia may be discontinued. The grafts may be applied as the patient is emerging from the anesthesia and being treated for shock. If, after procuring these grafts, the condition of the patient does not permit the continuation of anesthesia, or further procedures, the grafts may be preserved by refriger-

ation at ordinary ice box temperature for 14 days.

### Use of Homografts

Fresh or cadaver grafts have been advocated when there are scanty donor areas, or the patient's condition does not permit autogenous grafting.

These grafts are often life saving procedures in extensive burns, as they act as biological dressings to prevent loss of oozing fluids that are so important to the patient. They are not permanent grafts, as they eventually disintegrate and must be replaced by autogenous grafts.

### Dressing the Grafted Areas

In covering large areas it is not necessary to suture the grafts in place. If pressed firmly against the raw surface, the grafts will soon adhere and compression dressings will hold the skin on the surface. The placing of compression dressings following skin grafting is important to the Anesthetist, especially if the dressings are around the throat or chest, as they may cause embarrassment to the respiratory functions. If an endotracheal tube is used, it is frequently left in place until the patient has fully recovered to extubate himself. It is also imperative that the patient remains anesthetized until the dressings have been applied, as the movements of an awakening patient may change the position of the grafts.

### Late Burn Problems

Areas of burns in the cubital, or popliteal regions or the neck often leave contractures due to scar tissue formation. These contractures frequently must be excised and grafted. Contractures of the chin and neck may cause obstruction of the airway during the administration of the anesthesia. When this complication is anticipated in adults, endotracheal anesthesia is preferable. The tube may be inserted under topical or trans-tracheal injection and the anesthesia is easily managed once the tube is in place.

In children, it is more of a problem to get their cooperation and understanding. It has become necessary in several instances of contractures of the chin or neck to anesthetize the child as rapidly as possible, exerting slight pressure at the angle of the lower jaw to maintain a patent airway. After a few minutes of anesthesia, usually with vinethene, the surgeon excises the constricting band. The Anesthetist is then able to maintain a patent airway, and intubation is readily facilitated. After the endotracheal tube is inserted, anesthesia can be carried on as a normal procedure.

### The Use of the Electric Dermatone

There are many different types of dermatones. As a precaution against explosion, a dermatone with an explosive proof motor that has the approval of the Underwriters' Laboratories for use in the presence of explosive gases is advisable. When a questionable instrument is to be used, a non-explosive type of anesthesia such as, intravenous barbiturate combined with nitrous oxide and oxygen or spinal is advisable. The instrument used at our hospital is the Brown Electro-Dermatone, manufactured by the Zimmer Manufacturing Company and has an explosive proof motor.

## Rehabilitation

This does not tell all the story of the care of the burned patient. Even after the burn is healed, the final rehabilitation of the patient must be considered, both physically and psychologically. During the healing process, scars and contractures may form and require surgical revision. If rapid healing has occurred, these secondary procedures are more easily accomplished and with much better results than if deep scarring is permitted to develop by allowing granulations to accumulate. Likewise, the psychologic rehabilitation is rarely a problem if early healing has occurred and if the surgeon has an active interest in the patient and his problems.

## Summary

In brief, the care of the burned patient is:

1. Early treatment for shock with blood and fluids.
2. Observance of the urinary output and replacement of electrolytes and proteins. The nutritional condition is very important for the healing of the burned areas. A diet rich in proteins and high in calories with large amounts of vitamins is essential.

Anesthesia problems are chiefly obstruction of the respiratory tract and shock. To help combat these problems we use endotracheal anesthesia and administer blood or plasma for shock.

This paper has been written for the benefit of those of you who may be called upon to assist in the treatment and care of the burned patient.

The program of treatment was instituted in our hospital by Dr. Sumner L. Koch, and the late Dr. Harvey S. Allen, both Professors of Surgery at Northwestern Medical School, and for many years members of our attending staff of the Cook County Hospital. At the present time these measures are carried on by Dr. John L. Bell and Dr. William Stromberg, Jr., both associates of Drs. Koch and Allen.

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# Hypnoanesthesia
## A Review of the Literature

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Hypnosis has been used by medicine men, priests, and witch doctors in religion and medicine for centuries. In Egypt there were "sleep temples", practicing the technique, 3000 years ago, much as it is today. In Greece, the sick were treated and cured through hypnosis by religious leaders. The Hindu fakir, the South Pacific fire dancer and the Indian yogi of today use self-induced hypnosis to make their feats possible.[1]

The use of hypnotic anesthesia for surgery began in the 1820's, the first in America being hypnosis for nasal polypectomy. The first large series of case reports came from India[2] where thousands of operations were performed using hypnosis, more than 300 of which involved major surgical procedures. In the meanwhile, hypnosis for anesthesia was laid on the shelf in America and England. Morton, Long, Simpson, and Wells were experimenting with chemicals that would put patients into an unconscious state. These were considered much more reliable and much safer.

A sociological struggle to control man's behavior has existed from ancient civilization to the present day. Basically these include four methods. (1) Mechanical force is used in childhood and in some character disorders. This may take the form of paddling, physical restraint or many kinds of mechanical aids. (2) Threats, punishment and rewards may be used at any age. Suppression or alteration of behavior may occur though it is expensive and often not of permanent benefit. (3) Methods of persuasion or rational approach may be used. This may be effective though sometimes it fails because it takes time to find the reason for behavior. Often it is impossible to find a rational reason. (4) Suggestion is frequently used to control man's behavior. It is usually less time consuming and often successful. Suggestion may be brought about by expressing an idea which an individual accepts uncritically and which initiates appropriate behavior. It is transmitted to another individual through a mode of communication, usually language.

Hypnosis is a condition of selective hypersuggestibility specifically

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brought about in an individual by visual fixation upon a small target object and suggestion of relaxation by various symptoms of sleep (particularly heaviness of the eyelids and closure of the eyes[1]). It is not sleep, per se, for brain waves, reflexes, galvanic skin reactions, cerebral circulation, and blood pressure readings in hypnosis are the same physiologically as in the awakened state.

The literature is at variance regarding the percentage of people who can be hypnotized. DeLee states that 90% of all normal individuals can be hypnotized[1] whereas Masserman states that everyone can be hypnotized to some degree.[4] Heron states that for hypnosis to be successful both the hypnotist and the subject have to have the same aims.[5] Psychotic and feeble-minded patients cannot understand the aims and hence cannot respond to suggestibility. Success in hypnosis often reflects the abilities of the hypnotist. However, man is constantly struggling to free himself from the unknowns of nature and hypnosis is considered by laymen as mysterious. They are frightened that something will happen to them over which they have no control. The word, hypnosis, may carry with it great anxiety. In such cases, one author[5] substitutes the word suggestive relaxation. Also, a certain level of tension is conducive to the success of hypnosis.

Criteria for evaluating the success of hypnosis is difficult to formulate. There is a significant difference between uses of psychological and physiological or pharmacological techniques. If novocaine is injected into the area of the brachial plexus it will achieve the same effect in the majority of patients regardless of their beliefs, attitudes, past experiences or differences in hereditary constitution. The effectiveness of psychological techniques is complex, difficult to assess and less predictable.

Unless it is known how something acts, this again complicates the evaluation of a procedure. Kroger and DeLee consider hypnosis a synaptic ablation which effectively blocks somatic and autonomic pathways that transmit afferent pain impulses to higher sensoria.[6] Fatigue, pain, and memory centers seem to be especially involved. White writes that any theory of hypnotism is called upon to explain facts such as (1) the hypnotized person can transcend the normal limits of volitional control; (2) he behaves without experience of will or intention, without self-consciousness, without subsequent memory which under the circumstances one would expect; and (3) that these changes occur merely because the hypnotist says for them to occur.[7]

The dangers of hypnosis lie chiefly in errors of technique. There is no evidence that in itself hypnosis weakens the will, damages the nervous system or adversely affects mental and physical well-being of the individual. There is no way of ascertaining exactly how each individual will respond while in hypnosis. The best behaved individual may become difficult to handle. Some have minor emotional outbursts. The subject is asked to regress to a child-like level of thought organization. The subject's mind is filled with thoughts of the hypnotist. Macalpine feels that countertransference is an obligatory

and essential component of hypnosis.[8]

Posthypnotic difficulties may include headache, vertigo, nausea, depression, drowsiness and increased severity of neurosis or psychosis. Most of these complications are a result of improper technique. The hypnotist may influence the subject outside the hypnotic state. He must be aware at all times that if posthypnotic suggestions are offered, they must be realistic and individualized.

For almost a century it seemed that chemoanesthesia had completely supplanted hypnoanesthesia. The awakening came 15 years ago when obstetrical services began using suggestion as a substitute or adjunct to spinal or general anesthesia. DeLee wrote that there were two ways of blocking thought impulses from reaching the brain cells; one with drugs and the other by preventing the pain thought waves at the source, i. e. psychotherapy. Thought blocking can be done in most cases.[9]

For adequate success in patients during labor and delivery, hypnotic suggestion begins at the third month of gestation, being given two to three times per month. Anticipation is an important factor in intensifying the severity of labor pain. Thus, patients are psychologically prepared for labor early in pregnancy. Natural childbirth is a form of control of behavior by suggestion.

One criticism that has been made regarding hypnosis in childbirth is that the patient-physician relationship becomes a very dependent one. However, any obstetrician-patient relationship is a very close one because of the obstetrician "mother complex" during antepartum care as well as during labor and delivery. An important factor is to transfer dependency to the husband after delivery of the patient.

Physician time and inadequately trained hospital personnel in care of the hypnotized patients limit the frequency with which suggestive relaxation is used in obstetrics. Hypnosis activates and satisfies certain needs in some subjects. Perhaps in some instances irrespective of the disadvantages, this form of anesthesia is the one of choice. Autohypnosis may be of benefit if physician time is of the essence.

Hypnosis has been revived as a form of surgical anesthesia. Owen-Flood reports on an appendectomy done under suggestive relaxation only.[10] Apparently skeletal muscles were relaxed as well as if the patient had had other forms of anesthesia. Hypnotic suggestion should begin the evening before the scheduled procedure and continued the following morning. One difficulty encountered is that the operating room environment is not conducive to a quiet, sleep-inducing atmosphere, and personnel may distract the patient from attentiveness to the hypnotist.

Persistent pain has on occasion been an indication for hypnosis. There are a wide variety of disorders that do not respond well to analgesics. For example, patients with limited vital capacity, and general debilitated state may not tolerate large doses of narcotics. Patients with chronic illnesses build up a tolerance to drugs. Dorcus and Kirkner report the use of hypnosis in dysmenorrhea with good results.[11] Hypnosis may not be adequate for intractable pain

and neurectomy or chordotomy may be indicated.

The phenomenon of hypnotic anesthesia or analgesia is common in everyday life. A common experience is to find a bruise or scratch while undressing and wonder how it got there. If one is aware that he is going to get a "sock", equal to one just discovered, it would be quite painful. Many thousands of battlefield injuries occurred at a time when the soldiers were unaware of it. A fractured bone can be reduced within thirty minutes of the injury and an episiotomy can be repaired within five minutes of delivery without discomfort to the patient.

An anesthetist has excellent opportunities to use hypnosis as an aid in pharmacological anesthesia. It is a valuable tool for minimizing apprehension, fear and restlessness or removing preoperative anxieties entirely. Patients confronted with surgery are in a psychic turmoil. To some, surgery and anesthesia represent punishment for guilt feelings. Others have a feeling of helplessness, separation, fear of the unknown, loss of physical and psychic control, loss of an important organ (example, uterus), or complete change in body image. Fear of death is also quite clearly demonstrated in some patients. They may become frightened when a mask is placed on their face for fear they can no longer breathe. This is particularly true when a mask is fastened snugly with mask straps.

Anesthesia may be induced with brute force but use of suggestion is much more beneficial and humane. Knowledge of psychodynamics and psychotherapy is an essential prerequisite to any specialty. It is true that narcotics produce anesthesia much more simply, are easier to control, and effects are more predictable. However, frightened patients require more premedication, more anesthesia and more postanesthesia sedation. Complications during induction are more frequent in the excited patient.

There are five degrees of hypnosis, which are as follows:

(1) Insusceptible, in which there is no response to suggestion.

(2) Hypnoidal, in which there is relaxation, usually both physical and psychic.

(3) Light state, in which there is catalepsy of eyelids and limbs.

(4) Medium state, in which simple motor reactions can be carried out though there is amnesia and posthypnotic anesthesia.

(5) Deep state, in which there is an ability to open eyes without affecting the hypnotic states.[5]

Stage 5 is essential when hypnosis is used alone for anesthesia. However, the hypnoidal state is valuable when used with chemoanesthesia. An attempt should be made to prepare each patient for surgery with suggestive relaxation. Also, a positive approach in verbal communication should be used with each patient in the operating or delivery room.

Hypnosis is a belated but welcome recognition of the usefulness of psychiatric techniques in anesthesia, especially as an aid in chemoanesthesia.

*(Continued on page 271)*

# Open Heart Surgery

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The development of open heart surgery has been a milestone in the history of surgical progress. To accomplish this it was necessary to develop a means of interrupting blood flow through the heart without causing irreversible tissue damage from hypoxia. Two techniques are currently employed to make open heart surgery possible, hypothermia and extracorporeal circulation.

## Hypothermia

Bigelow[1] was the first to suggest the application of hypothermia to open heart surgery. He noted a decrease in metabolic rate at lower temperatures. This resulted in a reduction in oxygen requirements, prolonging the tolerance of the body to hypoxia.

At normal body temperature the brain will tolerate 3 to 4 minutes of complete circulatory occlusion without irreversible damage. At body temperatures of 80°-85° F. this period can be prolonged to 8-10 minutes. Subsequent studies have proven this interval to be adequate for the correction of certain congenital heart lesions.

Anesthesia for the induction of hypothermia may be given by one of several techniques. The basic requirements are prevention of shivering and maintenance of adequate oxygenation. Dr. Robert Virtue[2] of the University of Colorado employs Pentothal® induction and ether maintenance during cooling. Curare is employed to provide adequate relaxation and to prevent shivering.

Reduction of body temperature may be accomplished by several satisfactory methods. The simplest and most rapid is by immersion in ice water. Care must be taken to keep hands and feet out of the water to prevent frost bite. A more refined, though somewhat slower technique employs a special mattress containing a circulating refrigerant. This unit may also be used for rewarming.

Allowance must be made during induction of hypothermia for a downward "drift" in body temperature after discontinuation of cooling. Swan[3] has reported this to be 2/3 of the initial temperature drop. Cooling is usually discontinued at approximately 90° F., and a further drop to about 84° occurs. Once the temperature has stabilized, the patient will remain hypothermic, as metabolic rate is too reduced to cause spontaneous rewarming.

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Many interesting physiological changes occur with hypothermia. As mentioned, there is a reduction in metabolic rate which results in a decrease in oxygen requirements. Blood pressure is lowered and pulse rate slows. Respiratory rate decreases and with severe cooling efforts may cease. Renal, hepatic, and all other visceral functions are decreased. There is progressive depression of the central nervous system, eventually reaching a plane of surgical anesthesia at temperatures of 85°-90° F. Hematologic changes[4] include an increase in hemoconcentration and a decrease in WBC and platelets. Coagulation changes[5] occur with a tendency towards acceleration of intravascular clotting and depletion of coagulation factors.

The surgical procedure consists of a bilateral thoracotomy with a transsternal incision. Tapes are passed about the superior and inferior vena cava for inflow occlusion. Outflow occlusion may be provided with a non-crushing aortic clamp. During the 8 to 10 minutes of circulatory arrest the heart is opened and the defect repaired.

Certain complications have been recognized in the application of hypothermia to open heart surgery. Foremost of these is the occurrence of cardiac arrhythmias, especially ventricular fibrillation. This complication is prone to occur during circulatory arrest and may be related to myocardial hypoxia. Experience in the management of this complication has resulted in a marked improvement in mortality. Another complication of hypothermia has been that of hemorrhage. This is most likely to occur during the rewarming period and may be associated with a depletion of coagulation factors by intravascular clotting. Such bleeding usually responds well to the administration of fresh blood.

In spite of its limitations, hypothermia has had an interesting and important role in the development of open heart surgery. Application in the past has been largely limited to the simplest lesions, such as interatrial septal defects. Although this technique is quite successful in these cases, no provision is made for the more complicated conditions when encountered unexpectedly. To broaden the field of open heart surgery, research was directed to the artificial heart-lung.

## Extracorporeal Circulation

In 1939, Dr. Gibbon[6] described the first artificial heart and lung. This unit removed blood from veins prior to reaching the heart, and pumped it to an oxygenator where an exchange of oxygen and carbon dioxide occurred. The oxygenated blood was returned to the arteries, thus bypassing the heart and lungs. This unit represented the first successful artificial heart and lung apparatus. Its principles are employed today in several of the modern units.

The artificial heart and lung or pump oxygenator consists of two basic parts: a pump which takes over the function of the heart, and an oxygenator to temporarily replace the lungs. The function of the oxygenator is to allow for an exchange of oxygen and carbon dioxide. There must be an adequate surface area exposure of the blood to oxygen. The lung efficiently accomplishes this by passage of blood through the wall of thin oxygen-filled sacs or alveoli within the lung. These sacs comprise a total surface area of 90 square meters.

Several types of oxygenators have been developed to substitute for the lung. The simplest of these is the bubble oxygenator which depends on multiple thin-walled bubbles of oxygen for surface exposure. The blood and oxygen are delivered to a mixing chamber or "bubbler" where the oxygen is dispersed through many small holes as bubbles. This system was found to be one of the most efficient in oxygenating the blood and elimination of $CO_2$. One disadvantage was the difficulty in removing bubbles which would produce fatal emboli. This problem has been largely overcome by two recent developments. The first was the perfection of an efficient antifoam agent. This silicone compound has been found to effectively eliminate larger bubbles. To provide exposure of the bubbles to the antifoam agent a "debubbling chamber" was added. This chamber is lined with antifoam compound and receives foam from the bubbler.

DeWald[7] of the University of Minnesota is responsible for the second development designed to eliminate the small bubbles. This consists of a coil of plastic tubing called a "helix" because of its shape. Blood from the debubbling chamber flows into the helix and begins a circular decline downward. This provides an opportunity for the bubbles to rise to the top of the column and for the blood to settle to the bottom.

The bubble oxygenator has certain advantages over other oxygenators. Being composed of plastic, it may be autoclaved, providing absolute sterility. The unit is simple in design and relatively easy to construct. Furthermore, since the total cost of the plastic tubing is only about $30.00 it is not necessary to re-use each unit. The bubble oxygenator has had extensive successful clinical application. It is probably the most widely used unit in this country today.

At Mayo Clinic[8] extensive research has been done on a "thin film" oxygenator. This unit consists of a series of stainless steel screens. Blood flows over the screens in a thin film, providing surface area exposure. Oxygen is blown over the screens for oxygenation and elimination of $CO_2$. This type of unit has no movable parts and the blood remains free of bubbles. Of the various oxygenators, it is probably the least traumatic to the blood.

In the past this unit required Zephiran soaking for sterilization. This was not only awkward but perhaps inadequate. Recently a new unit has been devised which may be autoclaved.

Other oxygenator units have been devised and have been proven effective in human application. The two previously described units, however, are probably the most popular at this time.

## Pump

The other part of the artificial heart-lung consists of the pump. Two basic designs have had the most widespread application. The first of these, designed by Dr. DeBakey[9] consists of a revolving arm with a roller at each end. As the arm revolves, the rollers compress a loop of plastic tubing, moving the blood along with a pulsile flow. This unit will function at high or low flows with minimum trauma to the blood.

Another pump, the Sigmamotor, was devised by Dr. Lillehei at the University of Minnesota. This unit

employs a series of metal fingers which massage the blood along a segment of latex tubing. Originally this type pump had a limited volume output, but a larger model was recently produced to overcome this disadvantage.

The problems of extracorporeal circulation extend beyond the development of a satisfactory unit. The patient must be heparinized prior to by-pass to prevent clotting of the blood. After the procedure the heparin is neutralized with protamine. Another problem is related to priming the unit with blood. This blood must be drawn the day of surgery with heparin as an anticoagulant. A flow rate must be decided upon preoperatively and the pumps calibrated to this volume flow. The flow rate may vary from 35 to 100 cc/Kg/min., depending upon the capabilities of the individual unit and the size of the patient. It is interesting that children require relatively higher flow rates because of their greater metabolic rate.

## Anesthesia

Anesthetic management of patients undergoing extracorporeal circulation does not differ greatly from that of other thoracic procedures. Special care should be taken to maintain a light plane of anesthesia to prevent unnecessary central nervous system depression at the time of cardiopulmonary by-pass.

At Mayo Clinic[10] ether has been the agent of choice. This is employed in a closed system with a $CO_2$ absorption chamber. During the by-pass ether is vaporized into the system. Mendelsohn[11] has recommended the use of cyclopropane for extracorporeal circulation. He attempts to maintain only analgesia with patients often able to respond to questions. During by-pass cyclopropane (8%) is blown into the oxygenator in combination with oxygen.

At Baylor Hospital in Dallas, Wood[12] employs Pentothal® induction, followed by nitrous oxide and ether at a light plane of analgesia. Muscle relaxation is provided by curare.

During extracorporeal circulation we have found it helpful to record a number of variables. These include arterial and venous pressure, ECG, EEG, arterial and venous oxygen saturation, pH, $CO_2$, and plasma hemoglobin. These factors have been of great value to us in evaluating the efficiency of the pump oxygenator and in regulating its operation.

Surgery is carried out through a transternal bilateral thoracotomy. Catheters are passed through the right arterial appendage into the superior and inferior vena cava for removal of venous blood. After oxygenation, blood is pumped back into the arterial circuit via the femoral artery. Blood passes retrograde up the aorta and is distributed to all the body. The heart is not entirely free of blood during the by-pass as the coronary flow continues. This can be avoided by inducing complete cardiac arrest with potassium citrate injected into the coronary arteries. In a state of arrest the work of the heart is reduced and it will tolerate interruption of coronary artery flow. Cardiac action can again be started by flushing out the potassium with fresh blood from the pump oxygenator.

By employing the pump oxygenator, a variety of congenital and acquired cardiac lesions can be successfully corrected. Mortality depends

upon the complexity of the lesion and the preoperative development of irreversible changes. For favorable cases, such as simple interventricular septal defects, the mortality will probably not exceed 10%.

Complications of extracorporeal circulation include intravascular clotting, air emboli and cardiac arrhythmias. Heparin is employed to prevent clotting and this is later neutralized with protamine. Air emboli are avoided by antifoam agents, debubbling and helix chambers, reservoirs and air traps. The most common significant arrhythmia is that of complete heart block. This is especially common during repair of interventricular defects. The use of potassium for cardiac arrest may also be associated with a higher incidence of arrhythmias.

## Summary

Recent developments in surgical research have opened a new field of surgical endeavor, that of open heart surgery. This has made possible the correction of many congenital and acquired heart lesions which were previously fatal. Continued research in this field will bring about a reduction of mortality rates and a greater scope of application.

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# Emergency Management of Untoward Reactions to Drugs

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Acute reactions to drugs are manifest in a relatively small number of ways which are easily recognized and should be treated symptomatically.

It is basic in our medical discipline that to treat a patient's problem we take a history, do a physical examination, make a diagnosis and treat for that which we have diagnosed. In most situations we are derelict if any of these steps is omitted. I am proposing the thesis, however, that in acute emergencies it is adequate therapy to treat symptoms as they appear; that time spent in developing the other steps is deleterious; that drug reactions present only a small number of manifestations which threaten life; that these manifestations may be treated adequately with a small number of simple drugs.

This approach is advocated only for reactions to diagnostic and therapeutic drugs. It would not necessarily apply in reactions to the broad group of potential poisons associated with industry, agriculture or homes.

What are these reactions and how should they be treated?

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## Apnea

Free the airway and give artificial respiration by the best means available at the moment. The airway must be maintained by lifting the jaw, pulling out the tongue or inserting a pharyngeal airway or endotracheal tube if they are available. **Foreign material:** — Blood, vomitus, mucus, chewing gum — must be aspirated with suction, wiped out of the throat, or drained out of the airway by dependent position.

Artificial respiration is ideally given by intermittent inflation of the lungs with oxygen by mask or endotracheal tube and a resuscitator or manual compression of a breathing bag. When these are not available use mouth-to-mouth respiration, arm lift, back pressure, or simple compression of the chest until better means are available. Babies should be given mouth-to-mouth respiration or the "Teeter Board" method of tilting them through a 90 degree arc on one's arm, if no equipment is at hand.

Drugs have no place in the emergency treatment of apnea. *Whenever a patient stops breathing take the next breath for him by the best mechanical means available at that instant.*

### Circulatory Collapse

Give oxygen by mask, and administer vasopressors intravenously, until the blood pressure is normal. Any of the standard vasopressors will bring the blood pressure back to normal, provided enough is given. Of the less potent vasopressors [ephedrine, methoxime (Vasoxyl), mephentermine (Wyamine)]*, from 0.25 to 0.5 ml. may be safely administered intravenously to anyone whose blood pressure is below normal. If there is little response within two minutes, this dose may be doubled. If the response still is not adequate, a more potent vasopressor, diluted or in an infusion [phenylephrine (Neosynephrine), metariminol (Aramine), levarterenol (Levophed)].

The patient must receive 100% oxygen if he is to derive benefit from inhalation therapy, since when circulation is deficient the oxygen carrying capacity of the blood can be increased only by increasing the plasma saturation.

### Central Nervous System Stimulation — Convulsions

Give oxygen by mask and barbiturates intravenously until the convulsion stops. Any of the standard barbiturates that are available for intravenous administration may be used [thiopental (Pentothal), secobarbital (Seconal), pentobarbital (Nembutal), phenobarbital, etc.] The shorter acting agents are preferred because the subsequent period of depression is relatively short. If the convulsion cannot be stopped without arresting respiration, enough barbiturate should be given to induce this effect and the patient should then be treated for apnea.

### Allergic Reactions

**Anaphylactic Shock.** Give epinephrine intravenously and administer oxygen. Although anaphylactic reactions are often fatal, life has usually been saved when the patient has received 0.25 to 0.5 ml. of epinephrine intravenously within 30 seconds of the onset of the reaction. This could not have been accomplished if a syringe and epinephrine had not been at hand when the offending drug was given.

**Edema, Bronchospasm, Urticaria:** Depending on the persistence of the reaction, give epinephrine, antihistaminic drugs, cortisone, or all three. The subcutaneous administration of 0.2 to 0.5 ml. of epinephrine will reverse most of these reactions. Antihistaminic drugs [promethazine (Phenergan) 25 mg., chlorphenamine (Chlor-Trimeton), diphenhydramine (Benadryl) 50 mg.] may be given orally, intramuscularly, or intravenously according to the acuteness of the reaction. In resistant cases prednisolone sodium hemisuccinate (Meticortelone) 50 mg. may be given intravenously.

Pulmonary edema may necessitate the administration of oxygen under positive pressure. Laryngeal edema may necessitate tracheotomy, or intubation followed by tracheotomy.

**Nausea.** This distressing symptom is in itself rarely a threat to life, and usually ceases as the initially high concentration of a drug is dissipated, or when treatment is given for one of the factors mentioned previously. Nausea may be combated by giving

*Wherever in this article a series of pharmaceutical and proprietary names is given, it is a representative sampling and should not be construed as a complete list or as a recommended list of agents.

oxygen and one of the anti-emetic drugs [chlorpromazine (Thorazine), promethazine (Phenergan), cyclizine (Marezine)] or barbiturates.

**Elevated blood pressure.** This reaction may cause a severe throbbing headache, and carries the threat of cerebral hemorrhage, but is usually transitory. It may be treated by the inhalation administration of amyl nitrite.

### Recognition

Only four of the groups of reactions listed are likely to be an immediate threat to life. If this approach to treatment is to be effective, a potentially fatal reaction must not be overlooked; one must make sure in every case that the patient is breathing and that his blood pressure is normal. More than one reaction may be present; for example, when the blood pressure is low enough the patient is likely to stop breathing. One must also be alert to lesser degrees of this symptom—to the patient whose breathing has not stopped, but is depressed; to central nervous stimulation short of convulsions, such as "picking things off the wall" from an overdose of atropine, or the bizarre "out of touch with this world" reaction to lidocaine (Xylocaine).

### Examples

How would this plan of action apply to reactions from some of our common groups of drugs?

**Local anesthetic drugs** may cause circulatory collapse or central nervous system stimulation. Circulatory collapse should be treated with oxygen and intravenously administered vasopressors until the blood pressure is normal. Central nervous stimulation should be treated with oxygen and intravenously administered barbiturates. Lidocaine causes bizarre mental reactions which may not be recognized initially; the treatment is the same as that for central nervous system stimulation. Local anesthetic drugs may give rise to anaphylactic reactions, for which epinephrine must be given intravenously at once.

**Barbiturates** cause respiratory depression. Whether this results in inadequate respiration or in complete cessation of respiration, the patient must receive mechanical assistance through a patent airway.

**Iodized compounds for radiographic studies** [iodopyracet (Diodrast), sodium acetrizoate (Urokon), etc.] may cause nausea (treat with oxygen and barbiturates or anti-emetics), circulatory collapse (treat with oxygen and vasopressors), the allergic responses or even anaphylactic shock (treat with antihistaminic agents and intravenously administered epinephrine).

**Penicillin** may cause the allergic responses and anaphylactic shock. Antibiotic injections are today one of the commonest causes of anaphylactic shock. Whenever penicillin is injected, one should bear in mind that epinephrine may need to be given intravenously at once. For less severe reactions, one should administer epinephrine subcutaneously, or may give antihistaminic agents or possibly cortisone.

**Drug X:** When a reaction is developing, and the nature of the drug is unknown or one is not familiar with the properties of the drug, one should treat symptomatically those manifestations that are a threat to life. When the acute emergency is past there is time to investigate, and to inquire whether or not more specific refinements are needed.

## Components of an Emergency Kit

Relatively few drugs are needed for an adequate emergency kit. Oxygen is usually a necessary component. The anesthesia department of the Kaiser Foundation Hospital in Oakland has found it useful to assemble these components into a "crash cart", on which are kept a "D" cylinder of oxygen, mask, and bag. In a drawer are a laryngoscope, a stethoscope, a sphygmomanometer, endotracheal tubes, and connectors. The following drugs, with the appropriate syringes, needles, tourniquet, and alcohol sponges are kept on the cart. A daily check is made to see that all listed items are present.

| | |
|---|---|
| Epinephrine 1:1000 | 1 ml. ampules with snap tops |
| Barbiturates: | Thiopental in solution, pentobarbital or secobarbital solution in vials or any other barbiturate in solution |
| Vasopressors | Ephedrine 50 mg. in snap top ampules, phenylephrine (Neosynephrine) 10 mg./ml. in 5 ml. vials |
| Antihistaminics | Promethazine (Phenergan) 25 mg./ml. in vial. |

## Summary

Most acute reactions to drugs can be treated adequately by this simple scheme of symptomatic treatment.

**Apnea**: Free the airway and give artificial respiration.

**Circulatory Collapse**: Oxygen and intravenous vasopressors until the blood pressure is normal.

**Central Nervous System Stimulation — Convulsions**: Oxygen and intravenous barbiturates until the convulsion stops.

**Allergic Reactions (Urticaria, edema, bronchospasm)**: Subcutaneous epinephrine, antihistamines, cortisone.

**Anaphylactic shock**: Intravenous epinephrine.

# The Child as a Surgical Challenge

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Fewer problems confronting the anesthetist offer a greater challenge than that of a child requiring surgical therapy. This challenge lies in the form of psychological aspects as well as technical ones. To attempt to fathom the mind of a child is all too often fraught with disappointment. This disappointment approaches disaster when those who do not have understanding, do not possess a natural love for children, or who cannot project themselves into the world of a child and thereby capture the scope of their doubts and fears. The child catapulted prematurely into an adult world, is forced to attempt to adapt to our adult attitudes and to observe adult customs. The requirement of this type of advanced adaptation is difficult for a child under the most ideal of conditions. Under the adverse conditions requiring hospitalization, in which the child is deprived of his familiar environment and the closeness of those whom he loves and trusts, it may require all the sympathy and understanding possible to mold both his thinking and his behavior into an acceptable pattern for the events to come.

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The challenge of this situation is emphasized by the fact that a thorough knowledge of body physiology, a knowledge of the pharmacology of the drugs employed, the possession of technical skill and a sympathetic attitude are not totally sufficient in the anesthetic management of these patients. To meet clearly the challenge and to perform adequately the task accepted, it is necessary for the anesthetist to gain the confidence of the child, to respect his fears, to allay his anxieties, to reassure him regarding pain and to psychologically prepare him for the often terrifying experience of his trip into the unknown—sleep.

Goldman and Crain[1] have cited that both the parents and the child should be given an explanation of the need of the operation and the events leading up to the anesthesia together with a brief discussion of what to expect in the immediate postoperative or recovery period. Additionally, preliminary preparation must be made for the separation of the child from its parents. Since the parents represent security for the child, this may become a major problem. To disregard this problem may well lead to what Bierman[2] has termed "separation shock". To avoid this shock, the anesthetist must give

the preoperative explanations and also gain the confidence of the patient.

Jackson[3] has shown that physiologic harm can result from preanesthetic apprehension and that such a state can make the anesthetist's task infinitely more difficult and the risk more grave. The anesthetist wishes to avoid psychic trauma during induction which may result in a child whose terror leads to physical violence and sobbing, both of which will leave their indelible imprint upon the course of the subsequent anesthetic. A cooperative child can preclude a traumatizing experience, and the result will be a pleasant one for both the patient and the anesthetist. The anesthetist, or other personnel in surgery, should never deprive the child of a special doll, toy or well-worn blanket brought to surgery. These articles should be accepted seriously since they also represent security to the little patient. They should be carefully preserved and returned to the patient in the recovery room or the patient's room. To observe this concrete procedure adds significantly to the anesthetist's ability to solve the problem of the infant surgical patient.

An area presenting the possibility of a grave mistake is that of depriving the infant of nourishment and fluids for long periods preceding surgery. A dehydrated child is often a feverish child and becomes a poor anesthetic and surgical risk. Unless the nature of the surgery specifically contraindicates food material in the intestine, semi-solid foods and formula can be given to infants and children up to four hours prior to surgery. In infants, orange juice and water may be given in small amounts up to two hours before surgery unless some type of gastrointestinal surgery contraindicates any fluids. A serious injustice is done when children scheduled for surgery are placed on a waiting list and allowed to fret and thirst into a state of feverish agitation.

In older children, when all fluids by mouth are being withheld, the patient should not be allowed to brush his teeth since during this procedure large quantities of both water and toothpaste may be, and usually are, ingested. The importance of withholding food and fluids must be explained to the parents since all too often well meaning friends and family will decide that only "a little bit" will not hurt. The degree of effectiveness that the anesthetist is able to accomplish in these instances is a factor in his ability to solve fully the anesthetic and surgical problem.

Traumatic conditions, requiring surgical correction or other surgical emergencies which occur immediately or soon after eating, pose a problem for the anesthetist. In most of these patients, an endotracheal tube is clearly indicated since the danger of aspiration is ever present. Food may remain in the stomach for many hours after being ingested in cases where injuries have occurred. In the young patients, vomiting may be deliberately induced during induction by the use of the suction tip with the patient in steep Trendelenburg position.

The presence of fever in this category of patients presents another form in this challenge. Fever may lead to serious consequences and should be reduced below 101°F. before surgery is attempted. Lowering the temperature reduces the amount

of oxygen required by the patient and lessens the possibility of convulsions which might otherwise occur during anesthesia. The use of cold packs, sponges, baths, or enemas are preferred over the use of drugs to lower the body temperature in these patients. At this point, a serious word of caution should be said in regard to the use of atropine in children with elevated body temperatures. Fever, atropine, warm operating rooms, and open ether anesthesia too often set the stage for fatal heat retention.

Since the preparation of the child for surgery is of such great importance, we must pay particular attention to the use of preanesthetic drugs. All of the factors which indicate the use of anesthetic premedication in the adult are present in the child and generally these factors are of far greater magnitude. The pediatric anesthetist should become thoroughly familiar with the use of these drugs and the dosage of each in relation to the weight of the patient. One should never overlook the value of the use of the barbiturates in children. The use of these drugs combined with scopolamine or atropine often makes an ideal preanesthetic combination. Rectal thiopental sodium can be employed by the method described by Mark, Fox and Burstein[4] for an adjuvant to proper psychologic handling. Systems are often employed by anesthetists to determine dosage requirements. Such systems as the use of one milligram of meperidine for each two pounds of body weight or the use of 0.1 mg. scopolamine for each twenty pound unit as advocated by Harrison and Maytom[5] often prove valuable aids. The margin of safety is narrow in these patients and alteration of body physiology is quickly manifest by the over-zealous use of depressant drugs, inadequate respiratory exchange, or cardiovascular changes.

The management of these patients following induction offers another challenge. Choice of technic and agents are problems of their own. The standard equipment used for the adult is entirely inadequate, unless modified, for the infant or child. The use of this equipment rapidly leads to alteration of the physiology of respiration. This greatly alters the course of the anesthetic and may lead the patient to the brink of disaster. One undertaking pediatric anesthesia should be familiar with the special equipment Adriani[6] and others have adapted for their special usage.

The need for endotracheal anesthesia in children of all ages must be recognized. The fear of this procedure in infants is not justified and the indications for its use are often far greater than in the adult. A carefully placed tube of proper size may eliminate upper respiratory obstruction which may result from excessive adenoid tissue or enlarged tonsils. Patients with hare lip or cleft palate may benefit greatly from this procedure. The use of a tube assures an airway in the young edentulous patient who may become obstructed by their lips or tongue. Its use may also help to prevent the accumulation of carbon dioxide and eliminate some of the mechanical dead space. In these children some type of semi-open or non-rebreathing system is best employed. That recommended by Stephens[7] is excellent for this use.

Children with congenital cardiac disease present a special challenge.

These children are often hypoxic at rest, and as McQuiston[8] has pointed out, due to their low cardiac reserve and an inability to adjust to an increased oxygen need, crying or emotional excitement may lead to unconsciousness or convulsions. In these patients, psychic sedation and adequate preoperative medication are essential prerequisites to proper anesthetic management. Although relatively few anesthetists will undertake the management of these children for cardiac surgery, many will be called on to anesthetize these patients for other types of surgical procedures required.

Blood loss is properly a part of this discussion. Since blood loss in the child may lead to serious complications or even to complete disaster, it is highly important that we have something more than mere estimation of the amount of loss. At the present time the gravimetric method is the most simple and effective system for this determination. In procedures where blood loss is considerable, estimating the loss is crude and often tragic. Since accessible veins are often scarce and venipuncture may become a traumatic and painful procedure, we should, especially in major procedures, abandon this "hit or miss" technic and have a cut-down made, preferably on an ankle vein, so that adequate replacement of blood or fluids can be assured during the operative procedure. This should be done prior to the transport to the surgery suite if dehydration or electrolyte imbalance exists. We must always bear in mind that the blood volume is small and loss must be taken seriously. The pulse rate is variable from minute to minute and the blood pressure, in general, gives little positive information in small children.

The child deserves a special anesthetic evaluation. The agent used may range from local infiltration and a "brandy-nipple" to deep general anesthesia. This great latitude is a significant portion of the total challenge, and the exercise of proper selectivity is a highly consequential factor in successful management of the patient. Another general maxim that must be kept in mind at all times is that of the requirements of the surgeon. These requirements are equal in importance with patient factors and with the selectivity of technic and procedure. Also, a definite benefit accrues to the pediatric anesthetist who is well acquainted with the work of Leigh and Bolton[9] as set forth in their classical book on Pediatric Anesthesia.

In peroration, it should be restated that in order to be successful in the anesthetic management of this class of patients and to meet adequately and completely the challenge that inheres in this management, the anesthetist must develop the moral qualities of dedication and devotion and psychological insight into the immature mind as indispensable complements to technical knowledge and skill. If one can thus come fully prepared, then he will be able to transmute frightening surgical challenge into a pleasantly satisfying experience, and a naturally unwanted task into a labor of love. To serve with consecration in the realm of humanitarianism is the noblest of man's endeavors and the supreme challenge found in life itself. Serving the infant and pediatric patient lies within this ambit of endeavor.

*(Continued on page 271)*

# The Management of Anesthesia for Cardiac Surgery

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The anesthetic agent and technique provide the patient with the greatest possible safety to assure an ultimate recovery from the surgical procedure. An attempt is made to anticipate and to compensate for disturbances in physiological processes which are already present or which may be occasioned by the surgery.

Preoperative evaluation of the cardiac patient is paramount in anesthetic management. From a careful history, important information can be obtained as to the patient's daily routine of work and activity, his physical reaction to stress and strain, and his sleeping habits. Shortness of breath on climbing of steps, pain in the chest, and the number of pillows required for sleep are the symptoms which will functionally classify the cardiac patient. This is a measure of myocardial reserve which can be taxed during the induction, maintenance, and recovery period.

The size of the heart can be estimated by x-ray examination. Special attention should be given to this report, since there is a definite relationship to the patient's surgical risk. The electrocardiogram can indicate the degree of myocardial damage. Atrial fibrillation is associated with an enlarged left atrium, while ventricular irritability, as evidenced by frequent ventricular premature systoles, bigeminal or trigeminal rhythm, is related to digitalis intoxication or myocardial hypoxia. The right heart catheterization might indicate the degree of pulmonary tension. Pulmonary hypertension predisposes to fibrosis. A chest x-ray reveals the far advanced state of cor pulmonale.

The type of cardiac failure and its presence for a period of time are factors which are important. Episodes of pulmonary congestion can range from short periods of hemoptysis to pneumonitis or pulmonary edema. Ankle edema is a visible expression of fluid retention and ought to be relieved by diuretics. Pleural effusion and/or ascites is a state of concealed fluid

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which must be considered when drying a patient prior to surgery.

Liver enlargement deserves attention. Laboratory studies might include: (1) a Bromsulphalein dye clearance test to give some indication of liver reserve, as evident by the percentage retention of dye in 45 minutes; (2) the Thymol Turbidity test with the degree of flocculation in 18 hours, denotes liver cell damage; (3) the Transaminase test reported in units reveals protein damage, either in myocardium or liver; and (4) the Prothrombin Time denotes the efficiency of the liver for blood coagulation.

Table 1 is a simple means of scoring a patient as to his risk for surgery. An adequate and properly executed surgical and anesthetic procedure in a poor risk individual can promote an excellent result, while an inadequate and unphysiological surgical and anesthetic management in a good risk patient can lead to a disastrous outcome.

The effects of anesthesia and its possible complications upon coronary blood flow are most important in these patients with degenerative cardiac disease. One must anticipate the many factors influencing coronary blood flow in an attempt to prevent sudden or prolonged coronary insufficiency in the anesthetized patient. The volume of coronary blood flow more or less parallels mean arterial blood pressure so that a given fall in blood pressure results in a corresponding decrease in coronary blood flow.

TABLE 1

EVALUATION OF THE CARDIAC PATIENT FOR SURGERY

| | 1 | 2 | 3 | 4 | SCORE |
|---|---|---|---|---|---|
| Size of Heart | + 1 | + 2 | + 3 | + 4 | |
| Cardiac Rhythm | N.S.R. | Atrial Fibrillation | Ventricular Premature Systoles | Bigeminal or Gallop | |
| Pulmonary Tension | 0-40 | 40-60 | 60-80 | 80-100 | |
| *Type of Cardiac Failure | 1 | 2 | 3 | 4 | |
| Duration of Failure | 0-3 mos. | 3-12 mos. | 1-2 yrs. | over 2 yrs. | |
| Age of Patient | 5-30 yrs. | 30-45 yrs.<br>0- 5 yrs. | 45-55 yrs. | over 55 yrs. | |

*Cardiac Failure — one point for each

1. Pulmonary Congestion
2. Pleural Effusion or Ascites
3. Ankle Edema
4. Liver Enlargement

NAME_____

DATE_____

OPERATION_____

### Premedication

The premedication for congenital heart disease, most commonly found in children, consists of the intramuscular administration of Demerol in a dosage of 1 mg./lb. body weight, to a maximum of 100 mg. with atropine 0.1 mg./20 lb. body weight, except for the individual 20 to 39 lb. when 0.15 mg. is used. This medication is administered 45 to 90 minutes prior to the induction of anesthesia.

Patients with acquired lesions, usually adults, receive pentobarbital (Nembutal) 100 mg. at bedtime, to be repeated in 3 hours if necessary. A quiet, restful sleep is important the night before operation. One hour preoperatively, the patient receives an intramuscular injection of Sodium Seconal 0.5 mg./lb. body weight and atropine 0.3 to 0.6 mg., according to the preoperative cardiac rate (above 100/minute — atropine 0.3 mg.; between 60 and 100/minute—atropine 0.4 mg.; and below 60/minute—atropine 0.6 mg.). Patients with mitral insufficiency receive a smaller dose of atropine, namely; 0.3 mg., because a slow cardiac rate is preferred.

### Venous Cannulization

Early on the morning of surgery, venous cutdowns are performed with the aid of Xylocaine 1% local infiltration for the adult patients. Vinyl tubing which will accommodate the shaft of a 15 gauge needle is placed in the long saphenous vein above the right ankle and in the wrist vein of the arm on the same side as the surgical incision is to be made.

The cutdown of the lower extremity is used for the administration of blood while that of the upper extremity is for anesthetic agents and necessary cardio-vascular medications. For open heart surgery, employing the use of hypothermia or extracorporeal circulation, a third cutdown is placed in the other leg, in order to have a second avenue of entrance for the rapid administration of blood.

Infants and children are anesthetized prior to the placement of the venous tubing. This avoids excitement. Cutdowns are performed in both legs just above the ankles.

### Induction and Intubation

Infants under 15 lb. or those who are extremely ill and cyanotic, up to 30 lb. are intubated awake. Children are induced with cyclopropane and oxygen, with the addition of ether to an upper second plane, third stage level of anesthesia. Endotracheal intubation is then accomplished. The size of the endotracheal tube is the sum of the age of the patient in years and the number 18, giving the French calibration which is the outside circumferential measurement. Inflatable cuffs are not used until a #30F endotracheal tube is indicated.

Adult patients receive decamethonium bromide (Syncurine — 1 mg./50 lb. body weight) intravenously. This is followed immediately by intravenous Sodium Pentothal® 5%, in a dose of 2 to 2½ mg./lb. body weight. Insufflation of the lungs with 100% oxygen is performed for a period of one minute to permit distribution and maximum effect of the muscle relaxant and the barbiturate. Rapid oral endotracheal intubation is accomplished with direct laryngoscopy. The cuff of the endotracheal tube is then inflated to the point of resistance, as transmitted to the plunger of the syringe. The tube is then withdrawn until the cuff engages

at the cords. Oxygen 100% is administered to the patient and the lungs are inflated by rhythmically compressing the breathing bag.

During the 8 to 10 minute effect of the muscle relaxant, hyperventilation with oxygen 100% is continued at a rate of 24 to 28/minute, with an inspiratory pressure of 20 mm.Hg. (26 cm.$H_2O$) and an expiratory phase of zero pressure, in a 1 to 1.5 ratio of cycling time. A state of apnea is created by abolishing the hypoxic drive of the carotid and aortic bodies during Pentothal® sedation. Controlled respiration can thus be established. Within 20 to 30 minutes, respiratory alkalosis is produced.

### Pulmonary Dynamics

Hypoxia is the most common cause of cardiac arrhythmias and standstill during induction and maintenance of anesthesia. Respiratory acidosis predisposes to sinus tachycardia, hypertension and ventricular irritability. Excess carbon dioxide decreases the affinity of hemoglobin for oxygen. Vasodilatation and serious arrhythmias develop.

Table 2 is a condensation of pulmonary physiology. All factors must be constantly kept in mind during the management of anesthesia especially for cardiac surgery. With hyperventilation, there is a decrease in the venous carbon dioxide content from an average normal of 22 to 24 mEq. to 18 mEq. Inspiratory pressure of 15 to 25 mm.Hg. (20 to 33 cm.$H_2O$) and a ventilation of 800 to 1000 cc. are necessary to counteract the lung compliance of pulmonary hypertension and fibrosis in order to avoid suboxygenation and/or carbon dioxide accumulation.

### Maintenance of Anesthesia

Infants and children under 40 lb. body weight are maintained on a non-rebreathing technique using the Fink Valve or the AA Swivel Y Valve with a pressure limiting device on the expiratory side. A 6 liter flow of nitrous oxide and a 3 liter flow of oxygen are used with either cyclopropane 300-500 cc. flow or ether vaporized by the flow of gas. A one, two or three liter bag with a tail is selected depending upon the estimated tidal volume necessary for the particular individual.

Manual rhythmic compression of the bag will afford controlled respira-

TABLE 2

PULMONARY DYNAMICS

| | | | | |
|---|---|---|---|---|
| Pulm. Cap. Blood Flow | × | Tidal Vol. & $O_2$ Conc. | = | Arterial $O_2$ Sat. |
| Pulmonary Fibrosis | × | Pulm. Congestion | = | Lung Compliance |
| Lung Compliance | × | Muscular Energy or Applied Pressure | = | Inspiratory Vol. |
| Inspiratory Volume | × | Rate | = | Alveolar Ventilation |
| Alveolar Ventilation | × | Gas Diffusion | = | Expired $CO_2$ |

tion. There are instances when it is difficult to adjust the Fink Valve because of the course tooling of the screw cap. The breathing bag can be attached to the inspiratory side of the AA Swivel Y Valve which has been modified on its expiratory side. This valve has only an 8 cc. dead space.

Adolescents and adults receive a 50% - 50% mixture of nitrous oxide and oxygen, 3 liters of each gas, if no hypotension exists, i.e., greater than 20% of the average preoperative systolic blood pressure. The above gases are administered in a semi-closed system using the carbon dioxide absorption technique. If the eyelid reflex is present 50 mg. or 1 cc. of Sodium Pentothal® 5% is administered, intravenously. This amount of Pentothal® is given every 3 to 5 minutes as needed to a maximum dosage of 10 mg./lb. body weight, which is never exceeded. This degree of Pentothal® saturation has been found adequate, regardless of the duration of surgery.

Nitrous oxide, not in excess of 65%, and oxygen mixture has no toxic effect. The disturbances to myocardial conduction and contractility can be attributed to hypoxia. However, if the Pentothal® requirement is in excess of a safe saturation concentration or is a cause of hypotension, a switch to an ether-oxygen maintenance of anesthesia is indicated. Light ether anesthesia will increase the cardiac output and maintain cardiovascular tone through the adrenocardiac mechanism. The sympathomimetic effect of ether tends to maintain a more satisfactory blood pressure. Deep ether anesthesia should be avoided because of the downward displacement of the pacemaker to the atrium or the atrioventricular node.

Cardiac conduction defects might contraindicate the use of cyclopropane. However, in many clinics this agent has been used with success. If cardiac hyper-irritability becomes manifested, then lightening the plane of anesthesia or changing the agent to ether is indicated.

Until 3 years ago, procaine was used in a 0.1 or 0.2% intravenous infusion to decrease cardiac irritability. It is now definitely established that this is not necessary and might do harm through an accumulation of procaine to a concentration sufficient to decrease cardiac conduction time, as evidenced by a widening of the QRS complex.

External resistance to inflation of the lungs due to intercostal muscular activity is abolished by an intravenous drip of 0.2% solution of succinylcholine. This infusion is regulated to drip at a minute rate determined by one-third of the weight in pounds and can be calculated to be 1 mg./25 lb. body weight per minute administration.

Controlled hyperventilation is maintained at 20 to 25 mm.Hg. (26 to 32 cm.$H_2O$) inspiratory pressure and at an expiratory phase of 0 pressure while the chest cavity is open. These pressures are reduced to positive 15 mm.Hg. (20 cm.$H_2O$) inspiratory pressure and negative 4 mm.Hg. (5 cm.$H_2O$) expiratory phase, at the time of approximation of the ribs.

### Alveolar Ventilation

Adequate ventilation can be maintained by the educated hand for a duration of 2 to 3 hours required for the surgical procedure. However, ex-

perience and fatigue do play a part in the (1) maintenance of rate and volume of ventilation; (2) proper relationship of an inspiration to expiration (1 to 1.5 cycle) rhythm; and (3) return to 0 pressure during the expiratory phase.

The mechanical ventilators that are presently available are divided into 2 types: (1) volume limited and pressure variable features are present in the Morch Surgical Respirator and the Stephenson Controlled Respiration Unit; (2) pressure limited and volume variable features are exhibited by the Jefferson Ventilator, the Emerson Controller Assister and the Bennett Assister.

An additional feature of the Emerson Controller-Assister and the Bennett Assister is that they will follow the patient's initiation of inspiration as an assister, rather than being complete controllers of the respiratory cycle. The flow sensitive valve of the Bennett Assister requires the least amount of inspiratory effort by the patient. The bleed valve and the automatic release valve of the Bennett apparatus allow for adjustments to maintain a constant volume at a given pressure and preset flow of anesthetic gases in order to compensate for any variations in lung compliance. The Bennett Assister with its transmitted effect on the right atrium of the heart produces an inspiratory-expiratory pressure curve which most closely resembles that of the ideal physiological Cournand Curve.

## Carbon Dioxide Absorption

Carbon dioxide removal is facilitated by proper alveolar ventilation, either manually or mechanically. When the exhaled gas has reached the anesthetic apparatus, carbon dioxide must be removed by an efficient absorber and absorbent. The design and capacity of the absorbers commonly used offer a certain degree of efficiency. The absorbers of the Chicago 460 and the McKesson 625 anesthetic machines are grossly inefficient and possess internal leak-through of carbon dioxide. The Ohio 9B absorber possesses some rebreathing due to valvular incompetence and back lashing in the breathing tubes.

The Foregger To and Fro, CF 1 and CF 2 are efficient for a period of time but require changing of canisters every 1 to 1½ hours because of the channelling of the expired gas along the wall of the absorber, which is the path of least resistance. The Ohio 19 absorber is efficient but there is minor rebreathing due to back lashing in the breathing tubes, which could be eliminated by a valve mask assembly. The Roswell Park Absorber with the AA Swivel Y Valve Mask Assembly is totally efficient for a duration of absorption of 18 hours.

High moisture 15%, 4-8 mesh, soda lime or baralyme are effective absorbents for the removal of carbon dioxide.

## Operative Procedures

### A. Congenital Lesions

For many years corrective surgical procedures have been accomplished for the congenital extra-cardiac lesions namely, Patent Ductus Arteriosus and Coarctation of the Aorta. Pulmonary valvulotomy is performed by the Brock Procedure for Pulmonary Stenosis. Interatrial septal defect of the seccundum type can be closed effectively.

Open heart surgery, employing the use of hypothermia or extracorporeal circulation with either the bubble or

film oxygenator is now available for the corrective surgical treatment of interatrial septal defect of the primum type, interventricular septal defect and cases of Tetralogy of Fallot, by a repair of the interventricular septal defect and obliteration of the hindrance to normal pulmonary flow.

B. Acquired Lesions

Commissurotomy for mitral stenosis is the most frequently performed operation on patients with acquired heart lesions. Absolute contraindications to this procedure are: septicemia, marked cardiomegaly, gallop rhythm, intractable failure and marked pulmonary fibrosis. Cross plication of the mitral annulus (Nichol's Procedure) is performed for the correction of mitral insufficiency. Aortic Commissurotomy has been accomplished in the past as a closed technique by the transventricular route with the use of the Almeida dilator. Open heart surgery offers a more suitable means of correcting lesions of the aortic valve, either stenosis or insufficiency.

Coronary artery disease is presently treated with various types of operations. The principle is to bring about a revascularization of the myocardium. The Beck I procedure consists of opening the pericardium and introducing an abrasive into the pericardial sack. The Beck II procedure establishes an anastamosis between the coronary sinus and the aorta. The Vineberg operation is the implanting of the left internal mammary artery into the myocardium. The Bailey endarterectomy is indicated for patients with segmental occlusion of one of the main coronary arteries.

## Electrocardiographic Monitoring

The cardiac activity is noted continuously with a cardioscope and recorder. Sinus bradycardia exists when the heart rate is below 60/minute, and there is no conduction defect; atropine 0.4 mg. is the drug of choice. Sinus tachycardia is present when the heart rate is above 100/minute, and the rhythm is regular; methoxamine (Vasoxyl) 10 mg. or prostigmine 0.5 mg. is indicated. Arrhythmias from the atrium are: atrial paroxysmal tachycardia, premature contractions, flutter or fibrillation. Except for tachycardia, the other arrhythmias are considered irregular irregularities. The atrial rate is seldom less than 300/minute. Clinically the diagnosis is made by a pulse deficit between the apex and the radial pulse. Cedilanid and quinidine are the drugs most frequently used to control atrial fibrillation.

Rapid digitalization is indicated when signs of cardiac failure and pulse rate of over 100/minute are present. Cedilanid (Table 3) is the drug of choice in a dosage of 0.01 mg./lb. body weight. One-half of the determined dose is administered intravenously, and ¼ of the remainder intravenously in 20 to 30 minutes. The ¼ balance is given in another 20 to 30 minutes, if the pulse rate is not below 100/minute.

Disturbances of ventricular origin are usually due to digitalis intoxication or myocardial hypoxia. The most serious sequence of conduction is frequent ventricular premature contractions to bigeminal (coupling or pulses alternans) to ventricular tachycardia,

Ventricular premature systoles are the most common of all arrhythmias occurring during anesthesia. The presence of a rapid, thready pulse and distant heart sounds with hypo-

TABLE 3
DOSAGE FOR DIGITALIZATION
Cedilanid or Digoxin

0.03 mg./lb. 10-25 lb.
0.02 mg./lb. 25-50 lb.
0.01 mg./lb. 50 lb. and over

Administer one-half dose intravenously and repeat one-quarter dose q. 20-30 minutes.

| DRUG | ONSET OF ACTION | DURATION OF EFFECTIVE ACTION | DURATION OF ELIMINATION |
|---|---|---|---|
| Acetyl Strophanthaidin | 3 min. | 5 min. | 15 min. |
| Ouabain — Gamma Stroph. | 5 min. | 1 hour | 24 hours |
| Cedilanid | 20 min. | 3 hours | 36 hours |
| Digoxin | 30 min. | 4 hours | 48 hours |
| Digitoxin | 1 hour | 12 hours | 14 days |

tension and a narrow pulse pressure is indicative of ventricular tachycardia. Digitalis is contraindicated. Hyperventilation with oxygen, methoxamine (Vasoxyl) 10 mg. and lidocaine (Xylocaine) 2% 1 mg./3 lb. body weight have proven helpful to control this condition by slowing the pulse rate, elevating the cardiac output and systolic pressure.

Procaine and procaine amide do not give consistent results in the therapy of ventricular irritability. The procaine amide (Pronestyl) has been accompanied by an unwanted hypotension. In the presence of frequent ventricular premature systoles, the ventricular irritability has been decreased by lidocaine. Bigeminal (coupling) and trigeminal rhythm have been converted within 45 to 90 seconds following the intravenous administration of lidocaine. The duration of action of a single dose is approximately 10 minutes. It may be repeated every 10 minutes for a maximum of 4 administrations without toxic effects. Hypotension has not been a disturbing factor.

Ventricular fibrillation is the most grave of all cardiac irregularities. The only two ways by which the diagnosis can be made are electrocardiogram or direct visualization of the ventricles. Clinically it is difficult to differentiate from cardiac asystole. The treatment is variable with no drug capable of arresting the irregularity once present. Oxygen and artificial respiration are mandatory. Manual cardiac compression is indicated to nourish the ventricles by way of the coronary arteries. Electric countershock should be employed following adequate oxygenation if manual compression of the heart does not revert the rhythm. Untreated it is 100% fatal.

### Cardiovascular Dynamics

Table 4 summarizes the cardiovascular dynamics so important in the conduction of anesthesia for any major surgical procedure. Proper re-

TABLE 4
CARDIO-VASCULAR DYNAMICS

| | | | |
|---|---|---|---|
| Circulation | × | $\frac{\text{Blood Volume}}{}$ | = Venous Return |
| Venous Return | × | $\frac{\text{Cardiac Efficiency}}{}$ | = Stroke Volume |
| Stroke Volume | × | $\frac{\text{Rate}}{}$ | = Cardiac Output |
| Cardiac Output | × | $\frac{\text{Peripheral Resistance}}{}$ | = Blood Pressure |

placement of blood loss can mean the difference between success or failure. If there is a failing myocardium, as evident by venous distention of the neck veins and cyanotic mottling of the upper chest, neck and face, blood should be withheld. The compensated myocardium requires nourishment by way of the coronary arteries. Hypotension can be due to hypovolemia or decreased peripheral resistance.

The average blood loss is approximately 500 cc. during the opening of a unilateral thoracotomy. Minute to minute replacement of blood loss is mandatory to prevent hypotension with subsequent ischemia and hypoxia of the myocardium. Peripheral vascular collapse is treated with an intravenous drip of 500 cc. 5% dextrose in water containing Vasoxyl 100 mg. or Aramine 100 mg. The former is indicated when the pulse rate is above 100/minute; while the latter is used when the cardiac rate is below 100/minute. Indiscriminate use of vasoconstrictors with their increase of peripheral resistance can increase the work load of the heart. If the myocardium is on the verge of decompensation, this added energy demand can precipitate cardiac failure.

A blood volume determination is at times necessary to differentiate the tachycardia of hypovolemia and cardiac decompensation. The rapid administration of 200 cc. of blood in 5 to 10 minutes will cause a slowing of the cardiac rate, if hypovolemia exists. There is no change in the cardiac rate and no harmful effect noted, as pulmonary edema, if there is an impending cardiac failure. Further digitalization with Cedilanid is indicated.

Pulmonary edema is treated by jugular or femoral phlebotomy and the rapid withdrawal of 500 cc. of blood through a 15 or 17 gauge needle. Vigorous aspiration through the endotracheal tube and positive pressure ventilation with caprylic alcohol (1 part to 9 parts of water) and oxygen has proven beneficial. Restriction of all intravenous fluids is mandatory because of the inefficient propulsion of blood by the left ventricle. The drugs of choice are: aminophyllin 0.5 gm. intravenously, and Cedilanid 0.6-0.8 mg., depending upon the degree of pre-existing digitalization and the size of the patient.

### Immediate Postoperative Care

Tracheal aspiration is conscientiously performed after the chest has been closed "air tight" and the drainage tubes have been connected to underwater seal. The Emerson pleural suction pump is attached to a two bottle set-up whenever a moderate to severe lung leak is present. The endotracheal tube is not removed until the patient is fully awake, obeying

commands and breathing spontaneously and effectively. If there is an abundance of pulmonary secretion, difficulty in aspiration or lack of cooperation on the part of the patient, as to coughing, tracheostomy is performed. This affords an easy access to the tracheobronchial tree.

Atelectasis may begin gradually or suddenly. The bronchus becomes plugged with tenacious secretions, clotted blood or aspirated mucus and vomitus. Dyspnea, cyanosis and a rapid pulse develop. The degree of hypoxia is an added strain on the diseased myocardium. Tracheal aspiration or bronchoscopy is indicated. An endotracheal tube may be left in place for approximately 3 hours postoperatively without irritation. However, marked ulceration of the arytenoids can develop. A grayish-white pseudomembrane will appear in the posterior pharynx, glottis and trachea due to the irritation caused by the movement of the tube during each respiration. An early tracheostomy, when first considered, is deemed wise; rather than after hours of procrastination and perhaps added complications.

Intermittent positive pressure breathing is accomplished with a Bennett TV - 2P Therapy Unit. The flow sensitive valve is designed to assist breathing by inflating the lungs during inspiration under safe control oxygen pressure and to permit free unrestrictive passive exhalation without pressure. Alveolar ventilation is improved for oxygenation and release of carbon dioxide. When the patient has fully reacted from anesthesia and is maintaining an adequate respiratory exchange, nasal oxygen is instituted at a 4-6 liter flow. The inspired mixture has an oxygen increase of 4% for each liter flow.

The semi-sitting position with the head of the bed elevated at a 45 degree angle affords a better respiratory excursion. This position helps relieve the venous engorgement of right sided heart failure by pooling of blood in the splanchnic region.

Every effort is directed toward maintaining an adequate blood volume and blood pressure, supporting respiration and detecting any evidence of heart failure. Hypovolemia is manifested by arterial and venous hypotension. When arterial hypotension is accompanied by venous hypertension, an ineffective cardiac action is usually the cause. A blood volume determination is most helpful.

## Summary

Progress has been made during the past 10 years in the anesthetic management of a patient undergoing cardiac surgery. There is still room for improvement in the many phases of management and avoidance of complications. We must develop a simple means for a continuous recording of both arterial and venous pressures. Monitoring equipment must include a quick and accurate method of determining arterial oxygen tension, carbon dioxide content, blood pH and circulating blood volume.

Patients with cardiac disease do not tolerate excessive premedication or deep anesthesia. The preservation of life through cardiac action depends upon the degree of arterial oxygen saturation, arterial and venous pressure, blood volume and cardiac rhythm.

## References

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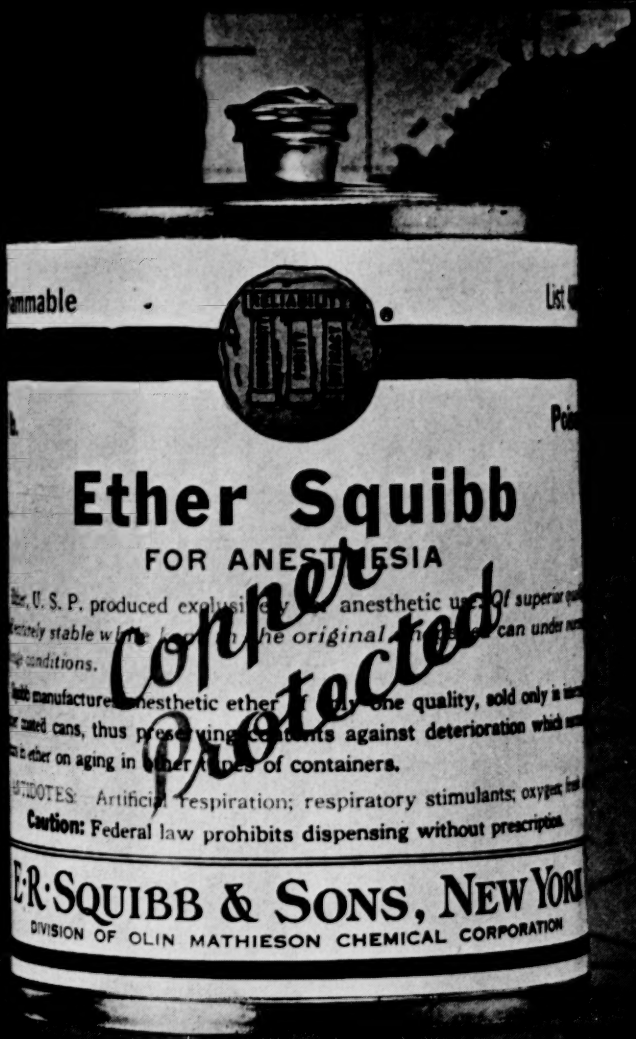
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# Notes and Case Reports

## Prevention and Control of Staphylococcus Infections in Hospitals[1] (Bulletin 1)

### Knowledge of Current Situation

1. It is clear that throughout the world, in spite of the enormous success of antibiotics (and, as will be mentioned below, to some extent because of this success) there remains an important problem of infections, a problem of special significance for hospitals. This report is concerned with such infections, particularly those caused by the coagulase-producing strains of staphylococcus aureus hemolyticus. The most obvious examples are impetigo and more severe infections in children, puerperal mastitis in recently delivered women, burn and postoperative wound infections, and pneumonia in debilitated patients. The staphylococcus may also be responsible for osteomyelitis, meningitis, septicemias, empyemas, boils and abscesses, otitis media, paronychiae, etc.

   Disease-producing staphylococci frequently implant in the nasopharynx without overt disease, thus producing carriers. Indeed, the staphylococcus carrier-rate is a good index of the level of contamination of the environment.

2. Many hospitals have a serious problem with staphylococcus infections, and all hospitals have a potential problem. Information is inadequate as to the incidence of staphylococcus infections which are acquired in hospitals, but there is evidence that the number of such infections is increasing.

3. There appear to be innumerable strains of staphylococcus capable of producing infections. Many of these staphylococci are susceptible to antibiotics. Some are not. Infections with antibiotic-resistant staphylococci constitute the main difficulty. Hospitals are clearly the reservoir of most antibiotic-resistant strains. Strains from the community at large are predominantly sensitive to antibiotics. The strains carried by patients on admission are less frequently resistant than strains which are acquired in hospitals. Patients who acquire these infections in the hospital are potential spreaders of resistant strains to the community after discharge. One of the major fac-

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[1]The Committee on Infections Within Hospitals is charged with the responsibility of recommending American Hospital Association policies and programs on the prevention and control of all infections within hospitals. Because of the general interest in the problem, this bulletin is devoted to the staphylococcus. Two earlier bulletins on Asian Influenza have been distributed.

This bulletin was prepared by the Council on Professional Practice's Committee on Infections Within Hospitals consisting of: Dean A. Clark, M.D., chairman; William A. Altemeier, M.D.; C. P. Cardwell Jr.; James P. Dixon Jr., M.D.; Maxwell Finland, M.D.; Horace L. Hodes, M.D.; Martha Johnson, R.N.; and Alexander D. Langmuir, M.D., in consultation with Kenneth B. Babcock, M.D., of the Joint Commission on Accreditation of Hospitals; William H. Stewart, M.D., of the Public Health Service; and others.

tors in the current situation is the widespread use of antibiotics which eliminates susceptible strains of staphylococcus and leaves uncontrolled the resistant strains[2].

4. Certain factors frequently found in hospitalization appear to make patients more likely to acquire such staphylococcus infections: a) routine indiscriminate use of antibiotics, especially for "prophylaxis"; b) long hospital stay; c) contact, direct and indirect, with infected hospital patients, staff members or personnel; d) crowding and inadequacy of facilities; e) prolonged operative procedures; f) prolonged use of continuous parenteral therapy through venipunctures or indwelling plastic tubing.
5. Certain factors in the host (patient) appear to increase susceptibility to infection: a) treatment with adrenocortical steroids; b) physical debility; c) chronic disease; d) prematurity; e) diabetes; f) bed sores; g) open wounds or breaks in the skin; h) chronic pulmonary disease.
6. Danger of infection seems to be especially great from direct exposure to people infected with the staphylococcus, although exposure to the same organisms in or on contaminated equipment, supplies, dressings, air, dust, wall or floor surfaces, linens, etc., may be equally as important. The physician, nurse or other attendant with a boil, paronychia, abscess, or nasopharyngeal infection with a virulent strain is particularly hazardous.

## Recommendations

I. All hospitals should establish Committees on Infections, to devote particular attention to infections which are acquired in hospitals so they may be reduced to the lowest possible minimum[3].

A. It is suggested that the Committee on Infections include, where possible, a bacteriologist, a pediatrician, a surgeon, an internist, a nurse, and a hospital administrator. The local health officer should be urged to serve as a consultant to the committee. The committee should report periodically to the executive committee of the medical staff.

B. The functions of the Committee on Infections should include at least the following:

1. To establish a system of reporting infections among patients and personnel, such a system being essential to a proper understanding of infections which are acquired in hospitals. The committee should have access to all reports of infections anywhere in the hospital.
2. To keep records of infections as a basis for the study of their sources and for recommendations regarding remedial measures.

[2]It is not known whether resistant strains of this organism actually acquire resistance after exposure to the antibiotics, or are resistant to begin with and are simply unmasked by the suppression of susceptible strains — although the latter is thought to be the case. From a practical point of view it does not matter which theory is correct.

[3]The Joint Commission on Accreditation of Hospitals is being asked to consider the establishment of a Committee on Infections as a major factor in the accreditation of a hospital. Bulletin 17 of the Joint Commission contains recommendations on the subject.

3. To distinguish to the best of its ability between infections acquired in the hospital and those acquired outside.
4. To review the hospital's bacteriological services to make sure that such services are of high quality and are accessible either in the hospital itself or in an outside laboratory. Bacteriophage typing, if not available in the hospital, may be sought, as needed, through official local and state health agencies.
5. To review aseptic techniques employed in operating rooms, delivery rooms, nurseries, and in the treatment of all patients with infections and, if indicated, to recommend methods to improve these techniques and their enforcement.
6. To make vigorous efforts to reduce to the minimum consistent with adequate patient care:
   a) Use of antibiotics, especially as "prophylaxis" in clean, elective surgery
   b) Treatment with adrenocortical steroids
7. To undertake an educational program to convince medical staff and hospital employees of the importance of reporting to responsible authorities when they have skin infections, boils, acute upper respiratory infections, and the like.
8. To establish techniques for discovering infections which do not become manifest until after discharge from the hospital, it being known that such infections are often overlooked because they may not be apparent until several weeks after the patient has left the hospital. Two approaches to discovering such infections are suggested:
   a) An attempt to trace the source of any infection with which a patient may be admitted. For example, if an infant is admitted with staphylococcal pneumonia or a recently delivered mother with mastitis, the hospital where delivery occurred should be determined and informed of the infection so that it can seek possible sources of infection.
   b) Periodic telephone polls on a random sample of discharged patients (particularly recently delivered mothers, newborns, and postoperative patients) to ascertain their state of health and, in case of any indication of infection, to follow them up. Such surveys have proved quite simple and quite valuable. A detailed account of the method is given by Ravenholt and others in the October 1956 issue of the American Journal of Public Health.

II. Hospital administration should undertake the following measures to assist in the control of infections:
   A. Diligent maintenance of the general cleanliness of *all* areas in the hospital, not simply in those associated with operating rooms, delivery rooms, and nurseries. Other possible sources, such as dust, air pollution (special attention should be given to ventilating

and air-conditioning systems and their filters), and floors must also be considered as potentially important factors in the spread of infection. There should be regular inspections of the hospital for general cleanliness.

B. Special studies among staff and personnel to uncover silent carriers of staphylococcus, especially in epidemic situations accompanied by repeated cases traceable to the same organism.

C. Appropriate measures for the treatment of all carriers who persistently show heavy growth of epidemic strains of staphylococcus in nasopharyngeal cultures or who are identified by epidemiological evidence.

D. Transfer of such carriers and personnel with skin infections, boils, acute upper respiratory infections, and the like from locations such as operating rooms, delivery rooms, food-handling positions, and nurseries to other duty stations in the hospital. Usually such transfers have proved to be sufficient to control the problem, but occasionally leave of absence for a persistent carrier has been necessary.

III. Hospitals should initiate or participate in community programs to control infection through cooperation with other hospitals, local medical societies, local health departments, and other groups.

**General Comment**

1. Occasionally, an entire hospital, a whole community, or a large area seems to become subject to an epidemic strain of staphylococcus. Why this occurs is not known. Its occurrence, however, points up the need for more general recognition and study of staphylococcus infections.

2. Among the agencies from which consultation and assistance concerning infection problems may be sought are the following:

   a) The American Hospital Association, the American College of Surgeons, and the American Academy of Pediatrics (especially for newborn infants) which will furnish upon request the names of suitable consultants.

   b) Local and state health departments which, in many instances, have experts on their staffs.

   c) The Communicable Disease Center of the U. S. Public Health Service, Atlanta, Georgia, whose assistance may be obtained through local and state health departments.

3. Valuable background information and discussion about the infection problem can be found in:

   a) Conference on staphylococcal infections. (Symposium) Journal of the American Medical Association. 166: 1177-1203, March 8, 1958; (Editorial p. 1205)

   b) Observations relative to the nature and control of

epidemic staphylococcal disease. F. H. Wentworth and others. American Journal of Public Health. 48: 287-98, March 1958

c) New York (State) Department of Health Guide for the prevention and control of infections in hospitals. Albany; 56p. illust. 1957

d) New York Academy of Science. Staphylococcal infections: a symposium. The New York Academy, 1956. 57 - 246 p. illust., tables. (Annals of the New York Academy of Sciences, 65: 57-246)

e) The problem of postoperative wound infection and its significance. W. A. Altemeier. Annals of Surgery. 147:770 1958.

Edwin L. Crosby, M.D.
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# Hospital Safety

## The National Fire Protection Association's Committee on Hospital Operating Rooms

The Hospital Operating Rooms Committee met in November, 1957 and January, 1958. Your representative attended both meetings. A report of the first meeting has already been made to the Board of Trustees and this report will include the high spots of that meeting as well as of the second meeting.

Of importance to anesthetists is the re-emphasis on the proper type of clothing to be worn by those who work in anesthetizing locations. This section in N.F.P.A. #56 has been reworded in an effort to make it still clearer, and the type of test for textiles or materials in apparel has been designated. Slips and uniforms of cotton and rayon are acceptable, but the particular fact to note is that these may be unmodified so as not to reduce their natural hygroscopic qualities.

Permanent finishes have been applied to cotton, for instance, which in some cases have completely negated cotton's advantages and brought it to the status of nylon as far as hygroscopic quality is concerned. Heavily applied starches in home and commercial laundries can greatly reduce this hygroscopic quality. Also rayon must be of the unacetylated variety, for cellulose acetate and celanese type of rayon have low hygroscopic values.

One section of N.F.P.A. #56 has now been written so it may be lifted as is from the standard and (with the insertion of a hospital's name and the name of the person responsible for enforcing the rules) may be used by any hospital as its official regulations for safe practice in anesthetizing locations.

This type of safety for patients is hospital business and the person responsible for the testing of personnel, equipment, floors and such is a legal representative of hospital management. That is why the hospital authority should be a hospital employee of supervisory status or on the management level. Various suggestions were made as to the identity of this person. The staff anesthesiologist, the operating room supervisor and the staff anesthetist were most often mentioned.

With more and more electrical equipment coming into use and more and more lawsuits being instituted, it is vital that each anesthetist know from personal reading exactly what is contained in N.F.P.A. #56.

One of the Hospital Operating Rooms Committee's next moves probably will be to make at least Part III of N.F.P.A. #56 mandatory. If so, it is likely that this section will appear in statute books of communities, states and cities.

Regarding ventilation in anesthetizing locations, the sanction of recirculation of air may startle some.

However, we must remember the scope of this committee does not include bacterial considerations. Also the range of flammability and anesthesia percentages of combustible anesthetic agents are almost the same. And unless a room is hermetically sealed, 100% recirculation could not be achieved.

Because resuscitator tubing looks like anesthesia tubing and could be interchanged, it has been recommended that manufacturers make both types of tubing conductive. Rubber tubing which is not conductive throughout is to be labelled specifically, such as "conductive inner layer."

The Hospital Operating Rooms Committee (unofficially of necessity) recommends that no advertisement be accepted for American Hospital Association, American Society of Anesthesiologists, or American Association of Nurse Anesthetists publications unless the manufacturer is complying with N.F.P.A. #56 recommendations. Advertisements in professional publications carry the implication of recommendation to many readers.

Portable electrical equipment was discussed and more detailed provisions written. Extension cords are not acceptable under any circumstances. It is heartening to note that some manufacturers are already complying with the recommendations for interchangeable electric plugs and receptacles.

A detailed revision and editing job was done on N.F.P.A. #565, Standard for Nonflammable Medical Gas Systems. This includes source of supply, cylinder manifolds and bulk supply systems; warning systems; pipe line systems; installation of piping systems and dispensing equipment.

At the January meeting a film was shown and a report given on the hazards of ether vapor trails. This caused considerable consternation and controversy because of its manner of presentation, and negative emphasis. Unless properly explained, gross misunderstanding could result from viewing the film and reading the report. Ignition of ether vapor to prove length and distance of its trails was accomplished only by cigarette lighter and matches. In no case was research done on static ignition of ether vapor. It indicates that under controlled circumstances ether vapor trails are not discernible for great distances.

The subcommittee on Plugs and Receptacles was terminated as their work has been completed. The subcommittees on Ground Indicators and Portable Electrical equipment were combined and renamed the subcommittee on Section #5. The subcommittees on Anesthesia and Oxygen Tents were combined and renamed the subcommittee on Inhalation Therapy. Your representative is a member of this committee. The subcommittees on Textiles and Clothing were combined and renamed the subcommittee on Section 6. This readjustment of subcommittees should facilitate the work of the Hospital Operating Rooms Committee. Your representative is a member of the new subcommittee on Review of Editorial Revisions.

HARRIET L. ABERG, C.R.N.A.
AANA representative on the N.F.P.A. Committee on Hospital Operating Rooms concerned with the National Fire Protection Association's publication #56, Recommended Safe Practice for Hospital Operating Rooms.

Any questions pertaining to hospital safety may be directed to the Executive Office. Answers will be included in this section in future issues.

# Legislation

Emanuel Hayt, LLB., Counsel A.A.N.A.

## Negligence of Anesthetist Causing Patient to Swallow False Teeth Held Question for Jury

The patient had been advised by the surgeon that it was necessary to have performed upon her a gastric resection to remedy a duodenal ulcer. He then made arrangements with the hospital to use its facilities, and he secured the services of the anesthetist who, however, was not to look to the surgeon for her compensation, but to the patient.

The operation is conceded to have been a success, and nothing appears in the record even suggesting a criticism of the surgeon's exercise of his skill. In preparation for it, the anesthetist was entrusted to make the patient unconscious and keep her so. While the patient was completely immobilized, the tube was inserted. The procedure itself which the anesthetist undertook to follow seems to have been regular and proper. Whether or not she was negligent in the performance of her services is the present concern.

It is not disputed that the patient's teeth were dislodged while the oxygen was being administered.

According to her deposition, the anesthetist called on the patient at the hospital the day before the operation for the purpose of determining the patient's fitness to undergo it. She said she examined the patient's teeth because it was "routine, to look at people's teeth, in giving people an anesthetic, to be sure they have their teeth. If they have a plate, take it out." She said she got the "impression . . . that the teeth were all right . . . [and] didn't dream that those two front teeth were false."

The "bronchotomist" who finally removed the teeth from the patient's lung testified that instruments such as were used could break teeth, that this was "possible" even when the greatest skill and care were exercised.

In rendering its decision, the court held: "We gather from these circumstances that the anesthetist cannot be said to have deviated from approved practice from the time she entered upon her duties when she examined the patient preparatory to the operation until the operation had been completed. But the fact remains that the teeth were broken and lost despite the anesthetist's consciousness of such a contingency as evidenced by the 'routine' examination obviously intended to prevent the very thing that occurred. And it should be remarked that she assumed none of the patient's teeth was false, and refrained from asking the patient if this was the case because, as appears from the deposition, the question would be insulting.

"We think it would not be amiss to commend the anesthetist for the concern she expressed for the patient's welfare, and the genuine effort she made to repair any damages that had been done by offering to bear the expense of replacing the lost teeth and by securing the services of the 'bronchotomist'. Moreover, it may be inferred from the statements in her deposition that she waived any charge for her services. Nevertheless, we are impelled to hold that the appellents are entitled to have a jury decide whether or not the anesthetist is chargeable with negligence and if she is, the amount of damages recoverable taking into account the expenses the anesthetist has defrayed.

"We conclude that the judgments in favor of the hospital and surgeon should be affirmed; that the judgment for the anesthetist be reversed."

(Dohr et al., v. Smith et al., 8 CCH Neg. Cases 2d 606-Fla.)

### Patient Fails to Prove Nurse Negligently Applied Tourniquet to Arm

Plaintiff was admitted to the Ochsner Foundation Hospital, August 5, 1947, and underwent an operation for diaphragmatic herniation. While recovering from the operation intravenous infusions were required and in connection with these infusions a rubber tourniquet was placed on his right arm. Plaintiff alleged that the nurse assigned to him negligently permitted such tourniquet to remain on his arm for an extended period of time as a result of which he developed axillary neuritis and deltoid muscle atrophy.

The evidence brought to light the following: The date the tourniquet was alleged to have been negligently left on plaintiff's arm was never shown convincingly or with any degree of certainty. No complaint of injury was made until four months had expired from the time of his discharge from the hospital. Corroborating testimony of plaintiff's witness, a hospital orderly at the time of the alleged accident, was somewhat suspicious in that he remembered the incident of five years ago so well. Expert testimony showed that various other causes could have brought about the injuries complained of. The testimony of plaintiff's wife as to the condition of his arm was not in accordance with plaintiff's testimony.

Throughout the time plaintiff was a patient in the hospital he made no complaint about the leaving of the tourniquet on his arm nor did he report that anything unusual had happened. To magnify this odd conduct of the plaintiff, there was a showing in the record that subsequent to the operation he complained of phlebitis in an ankle, and that he later underwent an operative process for correction of a glandular condition; yet no complaint as to the condition of his arm was made. Furthermore, the contents of the infusion bottle entered into the vein and the medical testimony that the contents of the bottle could not have entered the vein had the tourniquet been left on the arm was contradicted by the plaintiff.

Plaintiff could not be allowed to recover on the basis of his own testimony which the court found to be most unsatisfactory and consequently the decision of the lower court dismissing plaintiff's suit was affirmed.

(Davilla v. Ochsner Clinic et al., 8 CCH Neg. Cases 2d 630-La.)

# Book Reviews

**Law of Hospital and Nurse.** By Emanuel Hayt, LL.B., Lecturer in Public Health and Administrative Medicine, Columbia University; Counsel, American Association of Nurse Anesthetists, Hospital Association of New York State, Greater New York Hospital Association; Fellow of American Academy of Forensic Sciences; Lillian R. Hayt, M.A., J.D. of the New York Bar; August H. Groeschel, A.B., M.D., M.S., F.A.C.H.A., Associate Director, The New York Hospital; Assistant Professor of Public Health and Preventive Medicine, Cornell University Medical College; Colonel, Medical Corps, United States Army Reserve, and Dorothy McMullan, R.N., B.S., M.A., Director, School of Nursing, Russell Sage College, Troy, New York. New York, N. Y.: Hospital Textbook Co. Cloth. 395 pages. 1958. $10.00.

This book, by its title, would seem to present the problems of a legal nature that involve nurses and hospitals. Dedicated to better patient care, the authors have included many facets of the law in relation to nursing, not only the relationship of nurses to hospitals, but also of their relationships to physicians, patients, and others with whom they work.

The content of this book is the result of the authors' combined knowledge and experience of nursing problems, legal phases of nursing practice, medico-legal problems that may involve the nurse, and hospital administrative problems in relation to nursing and the law.

Brief excerpts from the table of contents will give sufficient information to stimulate the interest of the reader in a thorough study of the text. *The Nurse and the Law, Legal Control of Nursing Practice, Nurses and Lawsuits, Clinical Procedures by Nurses and Crimes: Civil and Criminal Aspects* are random samplings of the twenty-seven chapter headings.

Of particular interest to the readers of this *Journal* will probably be the largest chapter in the book, *Anesthesia by Nurses.*

Using illustrative cases giving the facts, the nature of the injuries, results of the lawsuits and the legal principles on which decisions were based, the authors have emphasized the lessons in patient care that can be learned from a study of past experiences of nurses and the law.

**Hospital Planning for the Anesthesiologist.** By William H. L. Dornette, M.D., Professor of Anesthesiology and Head of the Department, The University of Tennessee College of Medicine, Memphis, Tennessee; Anesthesiologist-in-Chief, The John Gaston Hospital; Chairman, Committee on Hospital Planning and Construction, American Society of Anesthesiologists, 1954-1958. Formerly, Assistant Professor of Anesthesiology, The University of Wisconsin College of Medicine, Madison, Wisconsin and The University of California School of Medicine, Los Angeles, California. Springfield, Ill. Charles C Thomas. 1958. $5.25.

Dr. Dornette has presented a practical guide on hospital design written for the anesthesiologist. The author

*(Continued on page 271)*

# Insurance

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# Abstracts

**Fraser, H. F., Wikler, Abraham, Van Horn, G.D., Eisenman, Anna J. and Isbell, Harris:** Human pharmacology and addiction liability of normorphine. J. Pharmacol. & Exper. Therap. 122: 359-369 (March) 1958.

"Although normorphine has not been established definitely as a metabolite of morphine, suggestive evidence to this effect exists. . . . Since . . . findings suggest the possibility that normorphine may prove to be an effective analgesic which will develop little evidence of physical dependence in clinical practice, the results of our studies on its pharmacology and 'addiction liability' are reported herewith. . . . The subjects used in these studies were adult white males serving sentences for violation of state or federal narcotic laws who volunteered for the experiments. . . .

"In single doses, normorphine caused less sedation, less depression of temperature, less respiratory depression and less pupillary constriction than did equal doses of morphine. Administration of 9 to 10 mgm. of normorphine every six hours for seven doses caused less, but longer-lasting pupillary constriction than did equal doses of morphine. Cumulation of the sedative effects of normorphine occurred in this experiment.

"When substituted for morphine in addicted patients, normorphine completely suppressed the morphine abstinence syndrome. The intensity of abstinence observed after withdrawal of normorphine was far less than the intensity of abstinence from morphine. Marked cumulation of sedative effects occurred during direct addiction to normorphine and prevented elevation of the dosage to the level which could easily have been attained with morphine. Partial tolerance to the sedative effects developed.

"Nalorphine precipitated definite abstinence syndromes in patients addicted to normorphine. Intensity of abstinence after withdrawal of normorphine was slow in onset and milder in degree than abstinence from morphine, methadone or codeine. As compared with predrug control values the urinary excretion of 17-hydroxycorticosteroids was depressed during chronic administration of normorphine and elevated transiently after normorphine was discontinued."

**Barrett, O'Neill, Jr.:** Convulsive seizures after administration of chlorpromazine. J.A.M.A. 166: 1986-1987 (April 19) 1958.

"Chlorpromazine has been widely used in recent years in the treatment of a variety of disorders. . . . One of the complications which has not received adequate attention but which is potentially quite serious is the epileptogenic effect of this agent. This effect has been noted primarily in patients with latent or overt convulsive disorders. . . . (In) two cases . . . convulsions apparently were precipitated by the administration of chlorpromazine. . . .

"No significant electroencephalographic changes are noted in the tracings of normal persons to whom the drug has been given. In known epileptics and also in persons later found to have a convulsive tendency, on the other hand, significant abnormalities of the electroencephalogram as well as actual convulsive seizures have been precipitated by administration of the drug."

**Chang, F. F. G., Safar, Peter and Lasagna, Louis:** Narcotic potency and side effects of anileridine and meperidine in man. J. Pharmacol. & Exper. Therap. 122: 370-378 (March) 1958.

"Anileridine is a new synthetic narcotic which is chemically related to meperidine. . . . We . . . attempted to evaluate the narcotic potency of anileridine and meperidine in surgical patients, and the side action liability in patients and healthy volunteers. . . .

"A method for studying narcotic potency in man . . . (utilized) the ability of narcotic drugs to reinforce nitrous oxide analgesia under controlled experimental conditions. . . . Our studies indicate that anileridine is a potent narcotic, which is not superior to meperidine. It produces respiratory depression and subjective side effects of a magnitude and with a frequency at least as great as seen after meperidine when both drugs are given in equipotent doses. The human data thus far available contrast dramatically with the reported superiority of anileridine in animals."

**Woodside, J. R., Del Rosario, Juliana, McKewen, Jane and Stubbs, Donald:** A new muscle relaxant drug, Prestonal. South. M. J. 51: 80-83 (Jan.) 1958.

"Prestonal appears to have a curare-like action, as shown by, — (1) a synergism with d-tubocurarine

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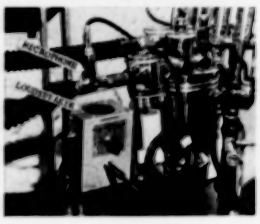

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NURSE ANESTHETIST — 100 bed general hospital. Two anesthetist staff —rotating call. Apply: Administrator, G. N. Wilcox Memorial Hospital, Lihue, Kauai, Territory of Hawaii.

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WANTED: Nurse Anesthetist. Apply: Personnel Department, St. Mary's Hospital, 2320 N. Lake Drive, Milwaukee 11, Wisconsin.

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WANTED: Nurse Anesthetist. Salary open. Apply: Charles H. Gillespie, M.D., Scott and White Memorial Hospital, Temple, Texas.

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NURSE ANESTHETIST WANTED: Modern expanding fully accredited hospital. College town of approx. 20,000. 170 bed hospital. Salary open, good working conditions. New O.R. with Recovery Room. O.B. anesthesia if desired. Apply: Administrator, War Memorial Hospital, Sault Ste. Marie, Michigan.

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ANESTHETISTS: Both staff and student positions available; 647 bed general hospital in college city; large variety of surgical and OB cases; all agents and techniques used and taught; hospital also conducts fully approved training for medical students, interns, residents, medical technologists, X-Ray technicians, and a school of nursing; housing and a stipend paid to students; staff anesthetists may start at $6344 annually. Apply: Personnel Director, Hurley Hospital, Flint, Michigan.

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REGISTERED NURSE ANESTHETIST for recently expanded general hospital centrally located in the city of Portland. New surgeries. Attractive position. Good working conditions with standard increments and personnel policies. Apply — Administrator, Holladay Park Hospital, 220 N. E. Multnomah St., Portland 12, Oregon.

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NURSE ANESTHETISTS (4)
University hospital—Anesthesiologists and Nurse Anesthetists. Large dept.—all types of anesthesia — all benefits. Apply Anesthesiologist in charge,
NEW YORK HOSPITAL—CORNELL UNIVERSITY MEDICAL CENTER,
525 E. 68th St., New York 21, N. Y.

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NURSE ANESTHETIST: to join ANESTHESIOLOGIST - HEADED group in private practice of anesthesia; $500 per month to start — percentage after 3 months, with average income of about $750 per month. Rotating call every 4th night. City of 75,000 population in Southwest Louisiana. Write, giving qualifications and full particulars to: LAKE CHARLES ASSOCIATED ANESTHESIOLOGISTS, 1901 Oak Park Blvd., Lake Charles, La.

WANTED: Two nurse anesthetists to complete staff in accredited 200-bed general hospital, located in suburb of Capital City of West Virginia. Call on rotation basis. Living quarters available in modern nurses residence. Air-conditioned working areas. Excellent salary and personnel policies. Attendance at professional meetings encouraged. Apply George I. Mattix, Administrator, Herbert J. Thomas Memorial Hospital, South Charleston, West Virginia.

## Book Reviews

*(Continued from page 261)*

includes useful information on getting started in a program, planning the specific hospital areas, and preparing for local disaster. This monograph is another in the American Lecture Series and will be of interest to anyone involved in a building program. Bibliography follows the text. Indexed.

PERENNIALLY YOURS, PROBIE. By Jo Brown. New York: Springer Publishing Company, Inc. Linen. 1958.

This delightful book is a characterization of the probationer, caught in the bliss of her unceasing youth. The author's sketches are appealing and will give great pleasure to nurses everywhere.

The TWENTY-NINTH QUALIFYING EXAMINATION for membership in the American Association of Nurse Anesthetists will be conducted on May 9, 1959. The deadline for accepting completed applications including the transcripts is March 30. Notice of eligibility will be mailed about April 12.

Applications should be forwarded early enough to allow time to request transcripts and have them returned to the Executive Office before the deadline date.

## Stark

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The author is indebted to Mrs. Leona Peck for checking the manuscript.

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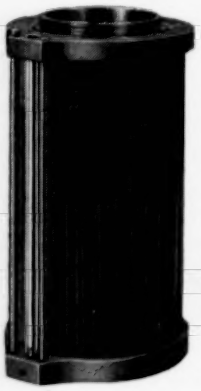

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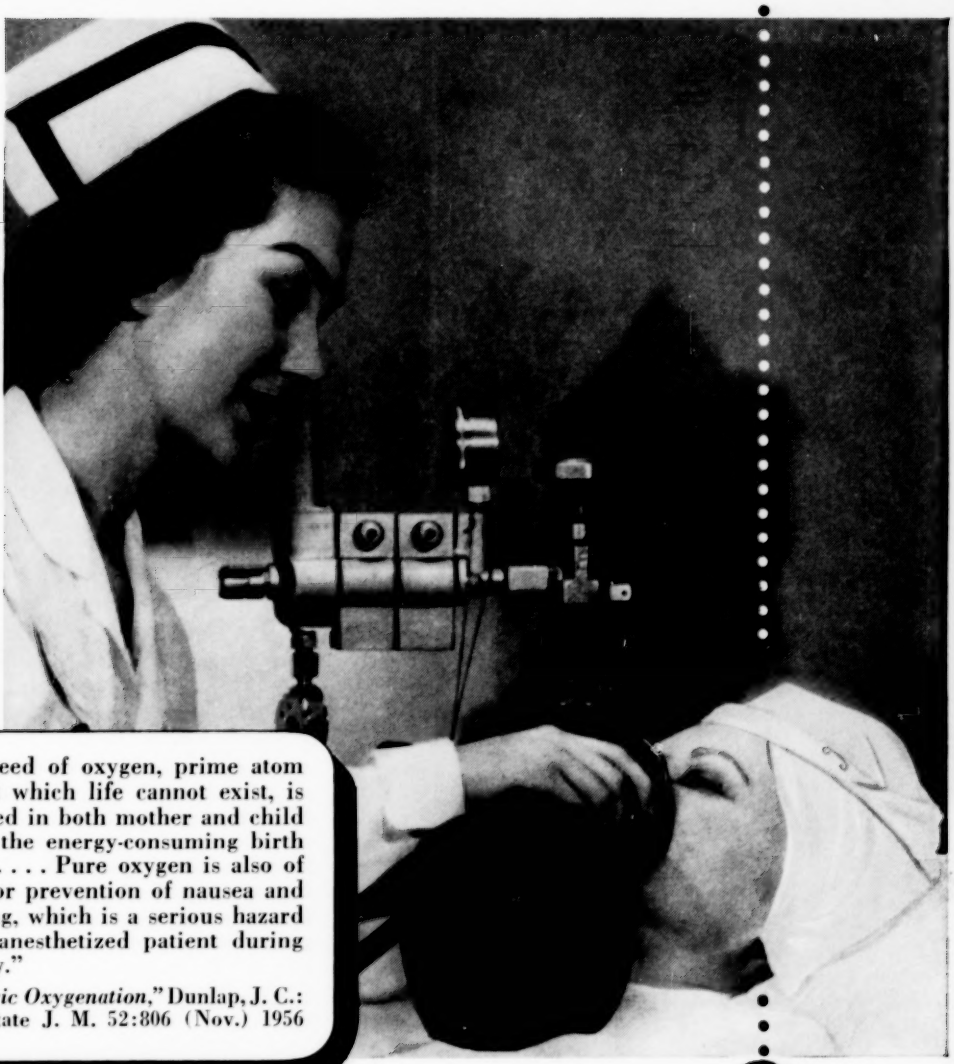

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